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FORMULATION AND EVALUATION OF HERBAL SOAP

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ABSTRACT

Herbal cosmetic formulations have gained significant attention due to their safety, biocompatibility, and therapeutic potential. The present study aimed to formulate and evaluate a herbal soap incorporating extracts of *Sapindus mukorossi* (Reetha), *Azadirachta indica* (Neem), and *Acacia concinna* (Shikakai) using the cold process saponification method. The selected plant materials were subjected to phytochemical screening, which confirmed the presence of bioactive constituents such as saponins, flavonoids, tannins, glycosides, steroids, and terpenoids. These compounds are known to contribute to cleansing, antimicrobial, antioxidant, and skin-conditioning properties. The formulated herbal soap was evaluated for organoleptic characteristics and physicochemical parameters including pH, foam height, hardness, moisture content, and total fatty matter. All parameters were found to be within acceptable limits, indicating good quality, stability, and skin compatibility. Antimicrobial activity of the soap was assessed against *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*, and the formulation exhibited significant inhibitory effects when compared with marketed soaps. The results of the study demonstrate that the combination of Reetha, Neem, and Shikakai produces an effective herbal soap with enhanced cleansing efficiency and antimicrobial activity. The formulated product offers a safe, natural, and multifunctional alternative to synthetic soaps and shows promising potential for cosmetic and therapeutic applications.

KEYWORDS: Herbal soap, Reetha, Neem, Shikakai, Phytochemical screening, Cold process saponification.

1. INTRODUCTION

1.1 Background of Herbal Cosmetics

Cosmetic products constitute an integral part of daily personal care, contributing significantly to hygiene maintenance and aesthetic enhancement. In recent years, there has been a marked transition toward the use of herbal-based cosmetic products, largely driven by increased awareness of the potential adverse effects associated with synthetic chemical ingredients. Herbal cosmetics are formulations that utilize bioactive substances derived from natural sources such as plants, minerals, and other naturally occurring materials. Compared to synthetic cosmetics, herbal products are widely perceived as safer, environmentally friendly, biodegradable, and better tolerated by the skin.

India possesses a rich heritage of traditional medicine systems, particularly Ayurveda and Unani, which emphasize the use of plant-based remedies for skin and hair care. The Indian cosmetic industry has historically relied on medicinal plants for the development of personal care products. Global market analyses indicate rapid growth in the herbal cosmetic sector, with products such as herbal soaps, shampoos, and creams capturing a significant share of the market. Among these, herbal soaps have gained considerable popularity as natural alternatives to conventional synthetic soaps.

1.2 Importance of Soap as a Cosmetic and Hygiene Product

Soap is one of the oldest and most widely utilized cleansing agents worldwide. Beyond its primary function of removing dirt and impurities, soap plays a crucial role in maintaining skin hygiene and preventing microbial infections. Conventional soaps are produced through the saponification of fats or oils using alkalis, most commonly sodium hydroxide. However, many commercially available soaps contain synthetic detergents, artificial fragrances, and chemical preservatives that may lead to undesirable effects such as skin dryness, irritation, and allergic reactions.

Additionally, synthetic surfactants used in conventional soaps are often non-biodegradable, contributing to environmental pollution. These concerns have highlighted the need for the development of herbal soaps formulated with natural oils and medicinal plant extracts, which provide effective cleansing along with additional therapeutic and skin-protective benefits.

1.3 Need for Herbal Soap

Herbal soaps offer a dual advantage by combining cleansing action with therapeutic benefits. Modern consumers increasingly prefer products that are natural, safe, and multifunctional. Incorporation of herbal extracts into soap formulations enhances their antimicrobial, antifungal, antioxidant, and moisturizing properties. Natural surfactants such as saponins obtained from *Sapindus mukorossi* (Reetha) provide gentle cleansing without disrupting the skin's natural lipid barrier.

Similarly, medicinal plants like Neem (*Azadirachta indica*) and Shikakai (*Acacia concinna*) not only cleanse the skin but also help prevent microbial infections and maintain overall skin health. Consequently, herbal soaps are increasingly favored over synthetic counterparts for regular and prolonged use.

1.4 Role of Medicinal Plants in Soap Formulation

Medicinal plants have been employed for centuries in traditional skin and hair care practices. These plants are rich sources of bioactive phytoconstituents such as alkaloids, flavonoids, glycosides, saponins, tannins, and terpenoids,

which exhibit a wide range of biological activities. Incorporation of plant extracts into soap formulations provides additional therapeutic benefits, including:

- Antibacterial and antifungal effects (Neem, Tulsi, Aloe vera)
- Natural foaming action (Reetha)
- Conditioning and antidandruff properties (Shikakai, Hibiscus)
- Antioxidant and anti-inflammatory activity (Turmeric, Green tea)

Thus, herbal soaps function as cosmeceutical products that offer both cleansing and therapeutic effects.

1.5 Plant Profile and Phytochemistry

1.5.1 Reetha (*Sapindus mukorossi*)

Reetha belongs to the family Sapindaceae. The fruits are rich in saponins (approximately 10–11%), which act as natural surfactants. Traditionally, reetha has been used as a natural cleanser, shampoo, and detergent. Pharmacological studies have demonstrated its antimicrobial, insecticidal, and mild analgesic activities. In soap formulations, reetha contributes to natural foaming and effective cleansing without causing skin irritation.

1.5.2 Shikakai (*Acacia concinna*)

Shikakai belongs to the family Fabaceae. Its pods contain saponins, tannins, and flavonoids and have been traditionally used as a mild cleanser and conditioner. Pharmacological properties of shikakai include antioxidant, antifungal, and anti-inflammatory activities. In soap formulations, shikakai acts as a gentle cleansing and conditioning agent, making the product suitable for sensitive skin.

1.5.3 Neem (*Azadirachta indica*)

Neem is a member of the family Meliaceae. Various parts of the plant, including leaves, seeds, and bark, contain bioactive compounds such as azadirachtin, nimbidin, quercetin, and flavonoids. Neem has been extensively used in Ayurveda for the treatment of skin infections, wounds, and inflammatory conditions. It exhibits broad-spectrum antibacterial, antifungal, antiviral, and anti-inflammatory activities. In herbal soap formulations, neem provides effective antimicrobial protection against skin pathogens.

1.6 Rationale of the Study

The rationale for combining Reetha, Shikakai, and Neem in a single soap formulation is based on their complementary functional properties. Reetha serves as a natural foaming and cleansing agent, Shikakai provides conditioning and mild cleansing effects, while Neem imparts antimicrobial and healing properties. The synergistic combination results in a balanced herbal soap formulation offering cleansing, protection, and conditioning benefits. Unlike synthetic soaps, the formulated herbal soap does not rely on artificial surfactants or preservatives, making it safer for long-term use.

1.7 Research Gap

Several studies have reported the formulation of neem-based soaps or soaps containing individual herbal ingredients. However, limited research has focused on the synergistic combination of Reetha, Neem, and Shikakai in a single soap formulation. Furthermore, scientific data regarding the comprehensive evaluation of physicochemical and antimicrobial properties of such combined formulations remain scarce. The present study aims to address this gap by developing and evaluating a herbal soap incorporating these three traditional medicinal plants.

2. Herbal Soap

Herbal soap formulations are topical preparations containing plant-derived antimicrobial and antifungal agents obtained from various plant parts such as leaves, stems, roots, and fruits. These formulations are primarily intended for the prevention and treatment of skin disorders and for maintaining healthy skin. Herbal preparations are commonly available in different dosage forms including creams, lotions, gels, soaps, ointments, and solvent extracts.

A wide range of skin infections are caused by microorganisms such as fungi, *Staphylococcus aureus*, and *Streptococcus* species. Traditionally, plant juices and extracts have been applied topically for their antimicrobial and anti-inflammatory properties in conditions such as eczema, ringworm, pruritus, and psoriasis. Herbal soaps prepared using medicinal plants help soften the epidermis, enhance penetration of active constituents, cleanse acne-prone skin, and promote faster healing.

2.1 Brief Overview of Herbal Soap and Its Benefits

Herbal soaps are prepared using natural ingredients such as plant extracts, herbs, and essential oils instead of synthetic chemicals. These soaps provide gentle cleansing while delivering multiple skin benefits. Natural oils such as coconut oil, olive oil, and shea butter help maintain skin hydration and prevent dryness. Additionally, medicinal herbs like chamomile, lavender, and calendula possess soothing and anti-inflammatory effects, making herbal soaps suitable for sensitive and irritated skin types.

2.2 Importance of Formulating and Evaluating Herbal Soap

Formulation of herbal soap involves the careful selection of medicinal plant extracts and natural oils known for their skin-beneficial properties. The ingredients are combined in appropriate proportions to produce a balanced formulation capable of cleansing, moisturizing, and nourishing the skin. Evaluation of herbal soap is essential to ensure product safety, efficacy, and quality. This includes assessment of physicochemical parameters, stability, skin compatibility, and compliance with regulatory standards. Proper quality control ensures consistency, reliability, and consumer safety.

2.3 Advantages of Herbal Soap

Herbal soaps offer several advantages over conventional soaps, including:

- Use of natural, skin-friendly ingredients
- Enhanced moisturizing properties
- Soothing and calming effects on sensitive skin
- Antimicrobial and anti-inflammatory activity
- Aromatherapeutic benefits
- Environmentally friendly and biodegradable nature

2.4 Disadvantages of Herbal Soap

Despite their benefits, herbal soaps may have certain limitations such as higher cost, shorter shelf life due to absence of synthetic preservatives, variability in quality depending on raw materials, potential allergenicity in sensitive individuals, and limited availability in mainstream markets.

3. Synthetic Soap versus Herbal Soap

Synthetic soaps are typically manufactured using chemical surfactants, artificial fragrances, preservatives, and colorants. Although effective in cleansing, prolonged use of synthetic soaps may disrupt the skin's natural lipid barrier, leading to dryness, irritation, and allergic reactions, especially in individuals with sensitive skin. Moreover, many synthetic ingredients are non-biodegradable and contribute to environmental pollution.

In contrast, herbal soaps are formulated using natural oils, plant extracts, and bioactive phytoconstituents such as flavonoids, tannins, and saponins. These components provide not only cleansing action but also therapeutic benefits including antimicrobial, antioxidant, and moisturizing effects. Herbal soaps are generally milder, help maintain the skin's natural pH, and are suitable for long-term use. Their biodegradable nature further makes them environmentally sustainable.

Figure no. 1: Herbal soap.

4. Plant Profile

4.1 Azadirachta indica A. Juss. (Neem)

Family: Meliaceae

Common Name: Neem

Plant Part Used: Leaves

4.1.1 Botanical Description

Azadirachta indica is a fast-growing evergreen tree attaining a height of approximately 15–20 m. It is indigenous to the Indian subcontinent and is extensively cultivated in tropical and subtropical regions. The plant possesses a deep taproot system that confers high drought resistance. The stem is erect with a rough, greyish-brown bark having a characteristic bitter taste. Leaves are compound, pinnate, and dark green with serrated margins. Flowers are small, white, fragrant, and borne in axillary panicles. Fruits are drupaceous, green when immature and yellow upon ripening, enclosing a single seed.

4.1.2 Phytochemical Constituents

Neem leaves are rich in bioactive compounds including azadirachtin, nimbidin, nimbin, limonoids, flavonoids, and tannins. These phytoconstituents are primarily responsible for the plant's broad spectrum of pharmacological activities.

4.1.3 Pharmacological and Medicinal Uses

Neem exhibits potent antibacterial, antifungal, antiviral, anti-inflammatory, antioxidant, and hepatoprotective activities. Traditionally, neem leaves are used in the management of various skin disorders, acne, eczema, and infections. Neem

oil obtained from seeds is widely utilized in soaps, cosmetics, and personal care formulations due to its insecticidal and antimicrobial properties.

4.1.4 Geographical Distribution

Neem is native to India and is widely distributed across South Asia including Pakistan, Bangladesh, Sri Lanka, Nepal, and Myanmar. It is also cultivated in Southeast Asia, Africa, Australia, and parts of Central and South America. The plant thrives in hot, dry climates and tolerates poor soil conditions.

4.1.5 Cultivation and Propagation

Neem grows well in well-drained sandy or loamy soils with a pH range of 6.2–7.5. It requires full sunlight and minimal irrigation once established. Propagation is primarily carried out through seeds, which exhibit high germination rates when sown fresh. Seedlings are transplanted after 3–4 months of nursery growth.

Figure no. 2: Neem.

4.2 Sapindus mukorossi Gaertn. (Reetha / Soapnut)

Family: Sapindaceae

Plant Part Used: Fruits

4.2.1 Botanical Description

Sapindus mukorossi is a medium-sized deciduous tree predominantly found in sub-Himalayan regions of India. The plant possesses a strong taproot and a rough, dark brown bark with vertical fissures. Leaves are alternate and compound with lanceolate leaflets. Flowers are small, white to greenish, arranged in large terminal panicles. The fruits are round, yellowish-brown drupes rich in saponins.

4.2.2 Phytochemical Constituents

The fruits of Reetha contain a high concentration of saponins along with flavonoids, tannins, and fatty acids, which impart natural cleansing and foaming properties.

4.2.3 Pharmacological and Medicinal Uses

Reetha is traditionally used as a natural detergent and shampoo. The pericarp exhibits antimicrobial, anti-inflammatory, and antioxidant properties. It is widely employed in herbal soaps and shampoos due to its mild cleansing action that does not disturb the skin’s natural microbiome.

4.2.4 Therapeutic Benefits

Reetha effectively removes dirt and excess oil from the skin while maintaining skin hydration. Residual saponins act as natural insect repellents and help manage acne, freckles, pigmentation, dryness, and other skin conditions. It is suitable for all skin types and age groups, particularly for individuals sensitive to synthetic detergents.

Figure no. 3: Reetha.

4.3 Acacia concinna (Willd.) DC. (Shikakai)

Family: Fabaceae (Mimosaceae)

Plant Part Used: Pods

4.3.1 Botanical Description

Acacia concinna is a woody climbing shrub native to tropical Asia. The plant has branched roots and thorny stems. Leaves are bipinnate with small, fern-like leaflets. Flowers are yellow and arranged in spike inflorescences. Fruits are flat, brown, pod-shaped structures containing saponins.

4.3.2 Phytochemical Constituents

Shikakai pods contain saponins, flavonoids, tannins, and alkaloids, which contribute to their cleansing, antimicrobial, and conditioning properties.

4.3.3 Pharmacological and Medicinal Uses

Shikakai is extensively used as a natural cleanser for skin and hair. It exhibits antifungal, antibacterial, antioxidant, and anti-dandruff activities. Leaves possess anti-inflammatory properties, while bark acts as a mild wound healer.

4.3.4 Benefits in Herbal Soap

Figure no. 4: Shikakai.

Shikakai-based soaps help treat skin infections such as scabies and reduce signs of aging including fine lines and wrinkles. Regular use strengthens hair roots, reduces dandruff, minimizes hair fall, and enhances hair volume and shine.

4.4 Ocimum tenuiflorum Linn. (Tulsi / Holy Basil)

Family: Lamiaceae

Plant Part Used: Leaves

4.4.1 Botanical Description

Ocimum tenuiflorum is a sacred perennial herb growing up to 30–60 cm in height. The plant has an erect, hairy stem and aromatic ovate leaves with serrated margins. Flowers are purplish and arranged in racemes. Seeds are small, brownish-black, and mucilaginous.

4.4.2 Phytochemical Constituents

Tulsi leaves contain eugenol, germacrene, terpenes, flavonoids, tannins, glycosides, phenolic compounds, and volatile oils.

4.4.3 Pharmacological and Medicinal Uses

Tulsi exhibits strong antioxidant, antimicrobial, and anti-inflammatory activities. It is traditionally used in respiratory disorders, digestive ailments, and skin infections. Seeds possess cooling and mucilaginous properties.

4.4.4 Pharmacognostic Characteristics

Macroscopic evaluation reveals aromatic, green to purplish leaves with a pungent taste. Microscopic examination shows diacytic stomata, glandular and non-glandular trichomes, oil glands, and vascular tissues characteristic of the Lamiaceae family.

4.4.5 Cultivation and Propagation

Tulsi grows well in warm climates with moderate rainfall. It prefers well-drained loamy soil with a pH of 6.0–7.5 and requires full sunlight. Propagation is mainly carried out through seeds, while vegetative propagation through stem cuttings is also practiced.

Figure No. 5: Tulsi.

5. MATERIALS AND METHODS

5.1 Materials

5.1.1 Plant Materials

The herbal ingredients used in the present study included fruits of *Sapindus mukorossi* (Reetha), leaves of *Ocimum sanctum* (Tulsi), leaves of *Azadirachta indica* (Neem), and pods of *Acacia concinna* (Shikakai). All plant materials were collected from local sources.

5.1.2 Chemicals and Reagents

The chemicals and reagents employed in the formulation and evaluation of herbal soap included sodium hydroxide (NaOH), coconut oil, castor oil, olive oil (used as base oils), distilled water, and ethanol. All chemicals used were of analytical grade.

5.1.3 Equipment

The apparatus and instruments utilized during the study comprised a Soxhlet extraction unit or maceration setup, heating mantle or hot plate, mortar and pestle, digital weighing balance, pH meter, beakers, conical flasks, measuring cylinders, rotary evaporator, Petri dishes, and microbiological culture media.

5.2 Methods

5.2.1 Collection and Authentication of Plant Materials

The selected plant materials were collected from authenticated local herbal sources. Botanical identification and authentication were carried out by a qualified botanist, and voucher specimens were preserved for future reference.

5.2.2 Preparation of Plant Extracts

The collected plant materials were thoroughly washed with water to remove adhering impurities and shade dried at room temperature. The dried materials were pulverized separately using a mortar and pestle to obtain coarse powder. The powdered plant materials were subjected to extraction using ethanol or aqueous solvent systems by Soxhlet extraction or maceration technique. The obtained extracts were filtered, concentrated, and stored in airtight containers at suitable conditions until further use in soap formulation.

5.3 Soxhlet Extraction Method

5.3.1 Materials Required

Dried and powdered plant materials of Reetha, Neem, Shikakai, and Tulsi were used along with 70% ethanol or water as solvent. Soxhlet apparatus, round bottom flask, condenser, heating mantle, filter paper, and rotary evaporator were employed during the extraction process.

5.3.2 Extraction Procedure

Accurately weighed quantities (25–50 g) of the powdered plant materials were placed in a thimble and inserted into the Soxhlet extractor. About 200–300 mL of 70% ethanol was transferred into a round bottom flask connected to the Soxhlet assembly. The solvent was heated to reflux, allowing repeated percolation through the plant material. Extraction was continued for 6–8 hours until the siphon tube solvent appeared colorless, indicating exhaustive extraction. The obtained extract was filtered and concentrated under reduced pressure using a rotary evaporator to remove the solvent. The concentrated extracts were stored in airtight containers for subsequent formulation.

5.3.3 Percentage Yield of Extracts

The percentage yield of the extracts obtained was calculated and found to be:

- Reetha: 12.5%
- Neem: 15.2%
- Shikakai: 11.8%
- Tulsi: 10.8%

5.3.4 Interpretation

Soxhlet extraction proved to be an effective method for isolating bioactive constituents such as saponins, flavonoids, and tannins. The technique ensures continuous extraction with optimal solvent utilization and enhanced recovery of phytoconstituents suitable for herbal soap formulation.

5.4 Formulation of Herbal Soap

Herbal soap was prepared using the saponification method. A calculated quantity of sodium hydroxide was dissolved in distilled water to prepare the lye solution. Coconut oil, castor oil, and olive oil were melted together and mixed uniformly. The prepared herbal extracts of Reetha, Neem, and Shikakai were incorporated into the oil mixture at predetermined concentrations. The mixture was stirred continuously until a thick, homogeneous consistency was achieved. The soap mass was poured into molds and allowed to set for 24–48 hours at room temperature. The prepared soaps were then stored for further evaluation.

5.5 Evaluation of Herbal Soap

5.5.1 Organoleptic Evaluation

The prepared herbal soap formulations were evaluated for color, odor, texture, appearance, and overall acceptability.

5.5.2 Physicochemical Evaluation

The soap formulations were subjected to various physicochemical tests including determination of pH, foam height and foam stability, moisture content, hardness, total fatty matter (TFM), and cleansing efficiency.

5.5.3 Antimicrobial Activity

The antimicrobial activity of the formulated herbal soap was assessed using the agar well diffusion method against selected microorganisms such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. The zones of inhibition were measured and compared with a marketed standard soap formulation.

5.6 Soap Formulation by Cold Process Method

5.6.1 Materials Used

- Coconut oil: 40 g
- Castor oil: 20 g
- Olive oil: 20 g
- Sodium hydroxide: 15 g (dissolved in 40 mL distilled water)
- Herbal extracts (Reetha, Neem, Shikakai): 10 g each

5.6.2 Procedure

The base oils were melted together under gentle heating. Sodium hydroxide was carefully dissolved in distilled water and allowed to cool to 40–45°C. The lye solution was slowly added to the oil mixture with continuous stirring until saponification occurred and the mixture reached the trace stage. Herbal extracts were then incorporated and mixed thoroughly. The soap mass was poured into molds and allowed to cure for 24–48 hours. After demolding, the soaps were stored in airtight containers for further evaluation.

5.6.3 Interpretation

The cold process method enabled effective incorporation of heat-sensitive herbal extracts without degradation of active constituents. The resulting herbal soap exhibited desirable cleansing, foaming, conditioning, and antimicrobial properties, attributed to the synergistic action of Reetha, Neem, and Shikakai extracts.

6. Evaluation

6.1 Phytochemical Screening

Preliminary phytochemical analysis of the ethanolic extracts of *Sapindus mukorossi*, *Azadirachta indica*, *Acacia concinna*, and *Ocimum tenuiflorum* was carried out using standard qualitative chemical tests. The extracts were screened for major secondary metabolites including alkaloids, flavonoids, saponins, tannins, glycosides, steroids, and terpenoids.

The results revealed the abundant presence of flavonoids, saponins, tannins, and glycosides in all plant extracts. Neem extract additionally showed the presence of steroids and terpenoids, indicating its superior antimicrobial and antioxidant potential. Reetha and Shikakai extracts were particularly rich in saponins, confirming their suitability as natural foaming and cleansing agents. Tulsi extract exhibited flavonoids, tannins, glycosides, and terpenoids, supporting its role in antimicrobial and skin-protective applications.

Summary of Phytochemical Screening

Phytochemical	Reetha	Neem	Shikakai	Tulsi
Alkaloids	–	+	–	–
Flavonoids	+	+	+	+
Saponins	+	+	+	+
Tannins	+	+	+	+
Glycosides	+	+	+	+
Steroids	–	+	–	–
Terpenoids	–	+	+	+

(+ Present, – Absent)

6.2 Evaluation of Herbal Soap

The formulated herbal soap was evaluated for physicochemical, functional, and antimicrobial parameters. The pH of the soap was found to be within the acceptable range (6.0–8.0), which is close to skin pH and minimizes the risk of irritation. Foam height and stability were significantly enhanced due to the presence of saponins from Reetha and Shikakai, confirming their effectiveness as natural surfactants.

The soap exhibited adequate hardness and low moisture content, indicating good physical stability and resistance to cracking. The total fatty matter (TFM) value was comparatively high, suggesting superior cleansing efficiency and skin-conditioning properties. Antimicrobial evaluation demonstrated notable zones of inhibition, particularly against common skin pathogens, which may be attributed mainly to Neem and Tulsi extracts.

6.3 Interpretation

The evaluation results validate the functional contribution of each herbal ingredient. Reetha and Shikakai impart effective foaming and cleansing action through their saponin content. Neem enhances antimicrobial and antioxidant properties due to the presence of flavonoids, tannins, steroids, and terpenoids. Tulsi contributes additional antimicrobial and protective effects, improving the overall therapeutic value of the formulation

7. RESULTS AND DISCUSSION

7.1 Phytochemical Screening

Preliminary phytochemical analysis of the plant extracts confirmed the presence of multiple bioactive constituents, including flavonoids, saponins, tannins, glycosides, and terpenoids (Table 7.1). Reetha extract showed a high saponin content, supporting its role as a natural foaming agent. Neem and Tulsi extracts were rich in flavonoids and tannins, which are known for their antimicrobial and antioxidant activities. The presence of these phytoconstituents validates the selection of plants for herbal soap formulation and explains their functional and therapeutic roles.

7.2 Physicochemical Evaluation of Herbal Soap

All soap formulations exhibited acceptable physicochemical characteristics. The pH values remained within the skin-friendly range, minimizing the risk of irritation. Moisture content was low, indicating good physical stability and reduced chances of microbial growth. Total fatty matter (TFM) values were comparatively high, reflecting superior cleansing and conditioning properties. Among the formulations, F3 demonstrated improved hardness, lathering ability, and TFM, suggesting better durability and cleansing efficiency, likely due to a higher concentration of saponin-rich extracts.

7.3 Organoleptic Properties

Organoleptic evaluation showed that all formulations were acceptable in terms of color, odor, texture, and lather. Formulation F3 exhibited enhanced lathering with a stronger herbal aroma, while maintaining an acceptable texture. These sensory attributes indicate good consumer acceptability and effective incorporation of herbal extracts.

7.4 Stability Studies

Stability testing conducted under different temperature conditions revealed that all formulations remained physically and chemically stable during the study period. Minor variations in color, hardness, and lathering ability were observed at elevated temperatures, particularly in formulation F3. However, these changes were not significant and did not affect overall product performance, indicating satisfactory stability under normal storage conditions.

7.5 Discussion

The results of the present study demonstrate the successful formulation of a multifunctional herbal soap using Reetha, Neem, and Shikakai. The synergistic action of saponins, flavonoids, tannins, and terpenoids contributes to effective cleansing, foaming, antimicrobial protection, and skin conditioning. Enhanced antimicrobial activity observed against common skin pathogens can be attributed mainly to Neem bioactives, while Reetha and Shikakai support foaming and cleansing through their saponin content. Compared to conventional soaps, the formulated herbal soap offers additional therapeutic benefits without synthetic additives, making it a safer and skin-friendly alternative.

8. CONCLUSION

The present research work successfully achieved the formulation and evaluation of a herbal soap incorporating extracts of *Sapindus mukorossi* (Reetha), *Azadirachta indica* (Neem), and *Acacia concinna* (Shikakai). The study demonstrated that the selected medicinal plants, when combined in an optimized formulation, produce a stable and effective herbal cleansing product with both cosmetic and therapeutic value.

Phytochemical screening confirmed the presence of key bioactive constituents such as saponins, flavonoids, tannins, glycosides, steroids, and terpenoids, which play a vital role in imparting cleansing, antimicrobial, antioxidant, and skin-conditioning properties. The cold process saponification technique enabled efficient incorporation of the herbal extracts, resulting in a uniform, smooth, and aesthetically acceptable soap formulation.

Evaluation parameters including organoleptic characteristics, pH, foam height, hardness, moisture content, and total fatty matter were found to be within acceptable limits, indicating good quality, stability, and skin compatibility of the formulated soap. The antimicrobial study further revealed that the herbal soap exhibited significant inhibitory activity against common skin pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*, supporting the therapeutic potential of the incorporated herbal extracts.

Overall, the study concludes that the formulated herbal soap offers a safe, natural, and effective alternative to synthetic soaps. The synergistic action of Reetha, Neem, and Shikakai enhances the cleansing efficiency while providing antimicrobial protection and skin nourishment. This formulation demonstrates strong potential for commercial application and encourages further research into polyherbal cosmetic products for improved dermatological benefits.

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