



FORMULATION AND EVALUATION OF HERBAL SOAP BY USING AEGLE MARMELOS FRUIT

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ABSTRACT

In recent years, there has been a growing interest in incorporating natural ingredients into skincare products due to their perceived safety and potential therapeutic benefits. Bael fruit (Aegle marmelos) is a well-known botanical resource with a rich history in traditional medicine.

The utilization of natural ingredients in personal care products has gained significant attention due to their perceived safety and potential therapeutic benefits. This study focuses on the formulation and evaluation of herbal soap enriched with bael fruit pulp, aiming to harness its antimicrobial and skin-nourishing properties. Bael fruit (Aegle marmelos) has been traditionally acclaimed for its medicinal value, containing bioactive compounds with antioxidant and anti-inflammatory attributes.

The formulation process involved the integration of bael fruit pulp extract into a soap base, optimizing concentrations to ensure efficacy and stability. Various physicochemical parameters such as pH, moisture content, and foaming ability were assessed to determine the quality of the formulated soap.

Results demonstrated that the incorporation of bael fruit pulp extract enhanced the functional properties of the herbal soap, exhibiting satisfactory pH balance, adequate moisture retention, and substantial antimicrobial activity. Furthermore, patch testing revealed promising skin tolerance, indicating the formulation's potential for safe and effective use in personal hygiene. The formulated herbal soap utilizing bael fruit pulp presents a promising natural alternative in the realm of skincare, offering potential benefits in cleansing, moisturizing, and microbial protection, thus warranting further exploration and commercialization in the cosmetics industry.

KEYWORDS: Herbal soap, Bael fruit pulp, Formulation, Evaluation, Antimicrobial activity, Skin compatibility.

INTRODUCTION

Soaps are considered to be harsh for your skin. Ordinary soaps can strip off the natural oil of your skin and leave it dry and dull. This soap doesn't add anything to your skin, rather take the glow away. The application of wrong soaps can lead to several skin issues such as dryness, excessive redness, acne, blemishes and irritation. However, herbal soaps can help reduce skin woes as they are composed of natural ingredients and herbs and are devoid of harmful chemical.

The use of natural ingredients in cosmetic products has gained significant attention due to their potential benefits for skin health and the environment. In this study, we focus on the formulation and evaluation of herbal soap by incorporating bael fruit, known for its medicinal properties, into the soap-making process. The significance of

incorporating bael fruit lies in its rich content of antioxidants, vitamins, and antimicrobial compounds, which can offer nourishing and protective effects on the skin.

The formulation process involves extracting the active components from bael fruit and blending them with other herbal ingredients to create a unique soap formulation. Through this research, we aim to explore the efficacy and quality of the herbal soap by conducting comprehensive evaluations using standardized methods to assess its cleansing properties, skin compatibility, and overall effectiveness. By understanding the formulation techniques and evaluating the performance of herbal soap with bael fruit, we can potentially uncover a natural and sustainable solution for skincare products that promote both health and environmental well-being.

Herbal soap preparation is a medicine or drugs it contain Antibacterial & antifungal agents which e mainly uses of part of plants such as like leaves, stem, roots &fruits to treatment for a injury or disease or to achieve good health [1]. This preparation possess antimicrobial property are administered topically and available to apply in various forms like creams ,lotion ,gel ,soap, solvent extract or ointment .the variety of creams & soap properties have been used to treat various skin disorders [2].

Mostly skin infection are caused by fungi, staphylococcus aureus and streptococcus species [1]. Ethnomedical, juice & extract from leaves of the plants are topically applied as antimicrobial and anti-inflammatory agents in treatment of skin disease including eczemas, ringworm and pruritus [3].

Significance Of Incorporating Bael Fruit In Herbal Soap

In the realm of skincare products, the incorporation of bael fruit in herbal soap carries substantial benefits. Firstly, bael fruit's antimicrobial properties make it a valuable addition to herbal soap formulations, aiding in cleansing the skin and preventing bacterial growth. Moreover, the skin-soothing properties of bael fruit contribute to the overall calming and nourishing effects of the herbal soap on the skin, making it an attractive ingredient for those with sensitive skin [3].

Additionally, bael fruit plays a role in the development and evaluation of anti-acne gel, showcasing its potential in addressing specific skin concerns such as acne. By including bael fruit in herbal soap, the effectiveness of the product can be enhanced, offering users a comprehensive solution for their skincare needs [4]. Furthermore, bael fruit's reputation as a remedy for facial skin-related problems underscores its value in promoting healthy and clear skin . Its ability to tighten the skin makes it a sought-after ingredient for those looking to achieve firmer and more youthful skin. Moreover, incorporating bael fruit in herbal soap can aid in moisturizing the skin, keeping it hydrated and supple. Lastly, bael fruit's properties can also assist in tan removal, offering users a natural and gentle way to restore their skin's natural complexion [5].

MORPHOLOGY OF BAEL FRUIT : [6]



Figure No. 1 Bael Fruit

1. Size and Shape: Bael fruit is typically large and spherical or slightly pear-shaped. The size of the fruit can vary, but it generally ranges from 5 to 12 centimeters in diameter. The shape may be slightly irregular, with a prominent equatorial ridge or furrow dividing the fruit into two halves.

2. Surface Texture: The surface of bael fruit is usually smooth but may have slight ridges or wrinkles. When ripe, the skin of the fruit turns from green to yellowish-green or yellow, depending on the cultivar and ripeness.

3. Skin and Peel: The skin or peel of bael fruit is thick and tough, with a leathery texture. It is typically green when unripe, gradually turning yellowish-green or yellow as the fruit ripens. The peel is often covered with a waxy coating that helps protect the fruit from moisture loss and microbial degradation.

4. Flesh and Pulp: Beneath the thick peel, bael fruit contains soft, aromatic, and fibrous pulp. The pulp is pale orange or yellow-orange in color and has a sweet, aromatic flavor with a hint of acidity. The pulp is divided into numerous segments, each containing one or more seeds surrounded by a gelatinous sac.

5. Seeds: Bael fruit contains numerous seeds embedded within the pulp. The seeds are surrounded by a mucilaginous pulp or sac, which helps protect them and aids in seed dispersal. The seeds are typically oblong or ellipsoidal in shape and may vary in size depending on the cultivar.

EFFECT OF BAEL FRUIT ON SKIN

1. Antioxidant Properties :

Bael fruit contains various bioactive compounds, including flavonoids, phenolic compounds, and vitamin C, which possess antioxidant properties. Antioxidants help neutralize free radicals in the body, which can prevent oxidative stress and damage to the skin cells. This may contribute to maintaining youthful and healthy-looking skin.[7]

- a) **Flavonoids and Phenolic Compounds :** Bael fruit is abundant in flavonoids and phenolic compounds, which are potent antioxidants. These compounds scavenge free radicals, preventing them from causing oxidative damage to cellular components such as DNA, proteins, and lipids. Flavonoids like quercetin and rutin, along with phenolic acids such as gallic acid and ellagic acid, contribute to the antioxidant activity of bael fruit.
- b) **Vitamin C :** Bael fruit is a good source of vitamin C (ascorbic acid), which is a powerful water-soluble antioxidant. Vitamin C acts as a free radical scavenger, donating electrons to neutralize free radicals and regenerate other antioxidants like vitamin E. It also plays a crucial role in collagen synthesis, promoting skin health and wound healing.
- c) **In vitro Studies :** Several in vitro studies have been conducted to evaluate the antioxidant activity of bael fruit extracts. These studies use assays such as DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging, ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) radical scavenging, and FRAP (ferric reducing antioxidant power) assays to measure the ability of bael fruit extracts to neutralize free radicals and reduce oxidative stress.
- d) **Health Benefits :** The antioxidant properties of bael fruit may contribute to various health benefits, including protection against chronic diseases such as cardiovascular disease, diabetes, and cancer. Additionally, antioxidants help maintain skin health by protecting against UV-induced damage, promoting collagen synthesis, and reducing the appearance of wrinkles and age spots. [8]

2. Anti-inflammatory Effects:

Some studies have indicated that bael fruit extracts possess anti-inflammatory properties. Inflammation is linked to various skin conditions, including acne, eczema, and psoriasis. By reducing inflammation, bael fruit extracts may help alleviate symptoms associated with these skin conditions.[9]

Some studies suggest that bioactive compounds present in bael fruit may inhibit the production or activity of inflammatory mediators such as cytokines, prostaglandins, and leukotrienes. By reducing the levels of these inflammatory molecules, bael fruit may help alleviate inflammation and associated symptoms in the skin.[6]

3. Anti-Microbial Effects :

Some studies have suggested that bael fruit extracts exhibit antimicrobial activity against various bacteria and fungi. This property may be beneficial for maintaining skin health by preventing infections and controlling acne-causing bacteria[10].

Bael extracts have shown antibacterial, antifungal, and antiviral activities. The antibacterial effect of bael was found on pathogenic *Shigella dysenteriae*, and the inhibitory activity was believed to be from coumarin compounds present in the extract. An antidiarrheal activity reported in Shoba and Thomas could also be due to the same or similar compounds. As an alternative to conventional antibiotics, a combination of bael and a popular antibiotic β -lactum was used, and inhibitory activity on β -lactam resistant *S. dysenteriae* and *S. flexneri* was obtained [11].

Marmelide extracted from bael have shown antimicrobial activity when experimented with coxsackieviruses B1–B6, in an assay described by plaque inhibition assay at 96 h. Without doing any toxic effects to host cells the extract is proved to have antiviral activity. In comparison to ribavirin, an anti-microbial drug, marmelide has been found to have more potential activity. The virucidal activity of marmelide and extract follows inhibition at the primary phase of a replicative cycle like adsorption as well as penetration [12].

4. Moisturizing and Hydrating Effects of Bael Fruit : [6]

- Water Content :** Bael fruit contains a significant amount of water, which is essential for maintaining skin hydration. Hydrated skin appears smoother, softer, and more supple, contributing to a youthful and healthy appearance.
- Natural Sugars :** Bael fruit also contains natural sugars such as glucose, fructose, and sucrose. These sugars can help attract and retain moisture in the skin, enhancing hydration and preventing moisture loss.
- Vitamin Content :** Bael fruit is a good source of vitamin C, which plays a vital role in skin health. Vitamin C is involved in collagen synthesis, a process that helps maintain skin elasticity and firmness. By promoting collagen production, vitamin C contributes to hydrated and youthful-looking skin.
- Topical Application :** While research specifically on the topical application of bael fruit for skin hydration is limited, anecdotal evidence suggests that applying bael fruit pulp or extract to the skin may help moisturize and hydrate dry or dehydrated skin.

5. Wound Healing :

In traditional medicine systems like Ayurveda, bael fruit has been used topically for wound healing purposes. It is believed to possess properties that promote the regeneration of skin tissue and accelerate the healing process. However, more scientific research is needed to validate these claims [3,9]

The wound healing technique comprises different steps namely inflammation, the proliferation of the cell, and contraction in the formation of collagen lattice. Reddening, pain, edema are basic symptoms associated with wound and also occur during inflammation. The release of reactive oxygen species is found to be a defense mechanism [12].

Table 1 : Taxonomical classification of Bael [13]

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Rutaceae
Genus	Aegle
Species	Aegle marmelos

Is a plant that is commonly distributed across India. *Aegle marmelos correa* is also called as bael, bilva, sriphal, or shivadruma (the Shiva tree in Sanskrit). This medication contains a number of phytochemicals, including alkaloids, tannins, essential oils, gums, resins, coumarin, and polysaccharides. This plant's fruits, stems, bark, and leaves are all edible. It has therapeutic characteristics and is used to treat a variety of eye and skin disorders.

Bael fruit is a seasonal fruit that is only accessible in May and June and cannot be utilized all year. Xanthotoxol' imperatorin marmelin marmesin psoralen. allo- imperatorin are the major constituents of bael fruit. The fruit was traditionally used to cure diabetes, respiratory problems, inflammation, dysentery, and diarrhoea. Aloevera has been recognized and used for generations for its healing, medicinal, and skin-care benefits. Miller family asphodelaceae aloe

barbadensis Fibers, organic acids, minerals, monosaccharides, and polysaccharides are the main components of aloe Vera.

Table 2: Chemical composition of Bael fruit [14]

Parameter	Values
Moisture (%)	56.91
Ash (%)	2.32
Fat (%)	0.47
Protein (%)	2.79
Carbohydrates (%)	29.21
Fiber content (%)	5.79
Titrateable Acidity (%)	4.72
Total Soluble Solids	16.79 °B x
Reducing Sugar (%)	7.52
Total Sugar (%)	13.25
Parameter	4.62

*Each value represents the average of the three determinations

Chemical Constituents of Bael :

- **Alkaloids** : The alkaloids comprise the largest single class of secondary plant substances. New alkaloids from the leaves of *Aegle marmelos* were reported viz., ethyl cinnamamide, O- 3,3-(di methylallyl) halfordinol, N-2-methoxy-2-[4-(3',3'- dimethylallyloxy) phenyl] ethyl cinnamamide etc.
- **Terpenoids** : The essential oil of *Aegle marmelos* (L.) Correa leaves were studied very much extensively in India by various workers since 1950. α -Phellandrene was found to be the common constituent of the essential oil from leaves, twigs and fruits. α -Phellandrene (56%) and p-cymene (17%) were reported from leaf oil. Later, similar report was published on leaf essential oil by many workers.
- **Coumarins** : Marmelosin, marmesin. imperatorin, marmin. alloimperatorin. methyl ether, xanthotoxol. scopoletin. scoparone, umbelliferone. psoralen and marmelide has also been reported.

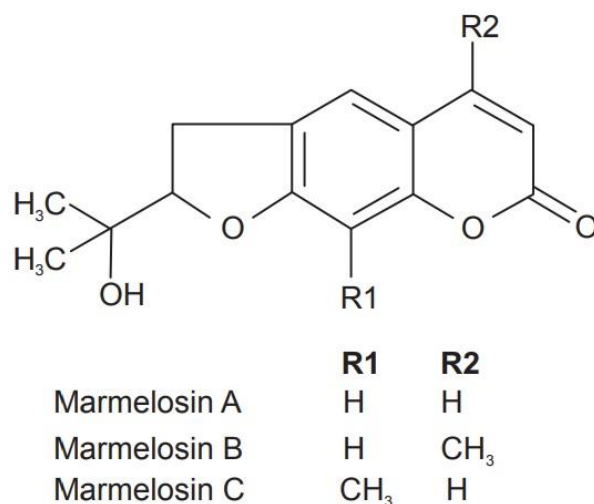
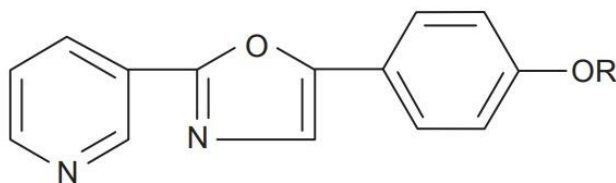


Figure 2 : Structure Of Marmelosin



O-Methylhalfordinol R = CH₃

Isopentylhalfordinol R = CH₂–CH=CH–

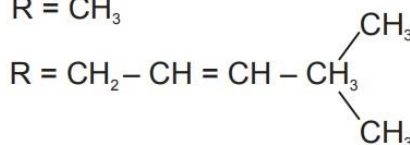


Figure No. 3 Structure

- **Phenylpropanoids** : These are naturally occurring phenolic compounds, which have an aromatic ring to which three- carbon side chain is attached. Among the phenylpropanoids are included hydroxycoumarins, phenylpropenes and lignans. The most widespread plant coumarin is the parent compound, coumarin itself, which occurs in over twenty-seven plant families. Marmesin was established as a new compound from leaves, which is also a constituent of heartwood and root
- **Tannins** : The maximum tannin content in bael fruit was recorded in the month of January. There is as much as 9% tannin in the pulp of wild fruits, less in cultivated type. Tannin is also present in leaves as skimmianine, it is also named as 4, 7, 8 - trimethoxyfuro- quinoline.
- **Polysaccharides** : Galactose, arabinose, uronic acid and L- rhamanose are obtained on hydrolysis.
- **Flavonoids** : Mainly includes Rutin, Flavone, flavan-3-ols, flavone glycosides. [15]

IDEAL PROPERTIES OF BAEL SOAP :

1. **Natural Ingredients:** Use natural and organic ingredients as much as possible to maintain the purity and integrity of the soap. Bael fruit extract or powder should be a prominent ingredient, providing its beneficial properties to the skin.
2. **Moisturizing and Hydrating:** Incorporate moisturizing agents such as glycerin, shea butter, or coconut oil to hydrate the skin and prevent dryness. Bael fruit itself contains natural sugars and water, contributing to its moisturizing properties.
3. **Antioxidant and Anti-inflammatory:** Enhance the soap's antioxidant and anti-inflammatory properties by including additional botanical extracts rich in these compounds. Ingredients like green tea extract, aloe Vera, or turmeric can complement bael fruit's benefits.
4. **Gentle Cleansing:** Ensure that the soap provides effective cleansing without stripping the skin of its natural oils. Use mild surfactants like coconut-derived or olive oil-derived cleansers to maintain the skin's pH balance and avoid irritation.
5. **Fragrance:** Bael fruit has a subtle, citrusy aroma that can be appealing in soap formulations. Consider using natural fragrances or essential oils to enhance the scent while avoiding synthetic fragrances that may cause sensitivity.

- Texture and Lather:** Create a luxurious lather and creamy texture that leaves the skin feeling soft and smooth. Experiment with different combinations of oils and butters to achieve the desired texture and lathering properties.
- Longevity:** Formulate the soap to be long-lasting, minimizing excessive softening or melting when not in use. This can be achieved by carefully balancing the proportions of oils and fats in the recipe.
- Suitability for All Skin Types:** Design the soap to be suitable for all skin types, including sensitive, dry, oily, and combination skin. Avoid common allergens and irritants, such as artificial colors and harsh chemicals, to ensure broad compatibility.
- Ethical and Sustainable Sourcing:** Source ingredients ethically and sustainably to minimize environmental impact and support local communities. Look for suppliers that prioritize fair trade practices and environmentally friendly harvesting methods.
- Packaging:** Consider eco-friendly packaging options, such as recyclable or biodegradable materials, to minimize waste and environmental footprint.

HERBAL SOAP :

Indulge in the refreshing luxury of our herbal soap, meticulously crafted with a blend of nourishing botanical extracts and pure essential oils. Infused with nature's goodness, our soap provides a rejuvenating cleansing experience that leaves your skin feeling soft, smooth, and revitalized. Harnessing the power of herbal ingredients known for their skin-loving properties, our soap gently washes away impurities while replenishing moisture, revealing a radiant complexion with every use. Immerse yourself in the enchanting aromas of natural botanicals, and treat your skin to the gentle care it deserves with our indulgent herbal soap.

BENEFITS OF HERBAL SOAP :

Numerous studies highlight the therapeutic properties of herbal ingredients commonly found in herbal soap formulations. For example, a study by Lall and Kishore (2014) discusses the antioxidant, anti-inflammatory, antimicrobial, and skin-soothing properties of botanical extracts such as neem, aloe vera, turmeric, and green tea. These ingredients are frequently incorporated into herbal soap formulations for their beneficial effects on skin health [16].

Additionally, research by Manjunatha et al. (2012) explores the antimicrobial and anti-acne properties of herbal extracts like tea tree oil and lavender, which are often used in herbal soap to combat bacterial and fungal skin infections. Overall, while there may not be a single reference outlining the benefits of herbal soap comprehensively, these studies collectively demonstrate the potential advantages of using herbal ingredients in skincare products [17].

Extraction Method :

- Preparation of Bael Fruit:** Fresh bael fruits (*Aegle marmelos*) are carefully selected and thoroughly washed to remove any dirt or impurities on the surface. The fruits are then peeled, and the pulp is separated from the seeds and fibrous parts. The pulp is chopped or sliced into small pieces to increase the surface area for extraction.
- Maceration:** The chopped bael fruit pulp is transferred into a clean and dry glass container with a wide mouth. An appropriate amount of methanol, typically 70-80% concentration, is added to cover the plant material completely. The container is tightly sealed to prevent evaporation and contamination.
- Extraction Period:** The bael fruit-methanol mixture is allowed to macerate at room temperature for a specified period, typically ranging from 24 to 72 hours. During this time, the methanol slowly penetrates the plant material, extracting the bioactive compounds present in the bael fruit pulp.



Figure No. 4 Extraction Period

4. Filtration: After the maceration period, the extract is filtered using a fine mesh or filter paper to remove solid particles and plant debris, yielding a clear methanolic extract enriched with the desired phytochemicals.

5. Evaporation: The filtrate is then transferred to a round-bottom flask and subjected to gentle evaporation under reduced pressure or using a rotary evaporator to remove the solvent (methanol). Care is taken to ensure that the temperature remains below the boiling point of methanol to prevent degradation of heat-sensitive compounds.

6. Storage: Once the solvent has been completely evaporated, the concentrated bael fruit extract is obtained. It is stored in airtight, amber-colored glass containers away from light and moisture to maintain its stability and potency until further analysis or use in research or formulation of herbal products.

IDENTIFICATION TEST OF MARMELOSIN :

1. A simple laboratory test to detect the presence of marmelosin in a sample can involve a colorimetric assay based on a specific chemical reaction. Here's a simplified version of such a test:

Materials Needed :

1. Sample solution (extracted from the bael fruit or containing the suspected marmelosin)
2. Sodium hydroxide (NaOH) solution (1 M)
3. Ferric chloride (FeCl_3) solution (0.1 M)
4. Distilled water
5. Test tubes or small cuvettes
6. Pipettes

Procedure :

1. Prepare the sample solution by extracting marmelosin from the bael fruit using a suitable solvent.
2. Take several test tubes or small cuvettes and label them accordingly for different samples or standards.
3. Pipette 1 mL of each sample solution into the respective test tubes.
4. Add 1 mL of 1 M sodium hydroxide (NaOH) solution to each test tube containing the sample.
5. Mix the contents of each tube thoroughly by gentle swirling.
6. Allow the mixtures to stand for a few minutes to ensure complete reaction.
7. After the reaction has occurred, add a few drops (around 0.1 mL) of 0.1 M ferric chloride (FeCl_3) solution to each test tube.
8. Mix the contents of each tube again by gentle swirling.
9. Observe the color change in each tube.
10. If marmelosin is present in the sample, a reddish-brown coloration should develop.

The intensity of the color may vary depending on the concentration of marmelosin in the sample.

2. Phenolphthalein Test :

0.1 gm of sample + water + 2 drops of phenolphthalein + dilute NAOH solution drop by drop till pink color persist.

Observation : Disappearance of Pink Color

Inference : Ester Group Present { Ester Group Present in Marmelosin }



Figure No. 5 Phenolphthalein Test

3. Hydroxamic Acid Test :

Mix 0.4 gm of compound with hydroxyl amine in ethanol and ethanolic sodium hydroxide, heat and cool, add HCL and then add FeCl₃

Observation : Deep Red Color

Inference : Ester Group Present

MATERIALS AND METHODS :

Table No. 3 : Ingredients

Sr. No.	Ingredients	Quantity (%)	Uses
1	Glycerin Base [water (H ₂ O) sodium hydroxide (NaOH) coconut oil stearic acid glycerin alcohol propylene glycol]	85%	Hardening, Surfactant, Moisturizing Properties
2	Bael Fruit Extract	14 %	Antioxidant, Anti-inflammatory, Antimicrobial, Antibacterial, Wound Healing

3	Rose Water	4-5 Drops	Perfume
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Sodium hydroxide [NAOH] :

Sodium hydroxide, commonly known as lye, is used in soap making because it reacts with fats and oils to create soap through a process called saponification. In simple terms, it transforms the oils and fats into soap, which is essential for cleansing properties.



Figure No. 6 Sodium Hydroxide

Coconut Oil :

Coconut oil is a popular ingredient in soap making because it produces a hard, cleansing bar with a rich lather. It contains lauric acid, which contributes to the soap's cleansing and foaming properties. Additionally, coconut oil adds moisturizing properties to the soap, making it suitable for various skin types.



Figure No. 7 Coconut Oil

Stearic Acid :

Stearic acid is a saturated fatty acid commonly used in soap making as a hardening agent and to provide stability to the soap's lather. It contributes to the firmness and longevity of the soap bar, enhancing its texture and durability. Additionally, stearic acid can also add moisturizing properties to the soap, leaving the skin feeling soft and smooth.



Figure No. 8 Stearic Acid

Glycerin :

Glycerin is a natural byproduct of the soap-making process called saponification. It is a humectant, meaning it attracts moisture to the skin, helping to keep it hydrated. Glycerin is often retained in handmade soaps, contributing to their moisturizing properties and making them gentler on the skin compared to commercial soaps, which often have the glycerin removed.

Alcohol :

Alcohol, such as ethanol or isopropyl alcohol, can be used in soap making to dissolve certain ingredients or to create designs in the soap. It can also help in evaporating excess water from the soap mixture, speeding up the curing process. However, excessive use of alcohol can lead to a drying effect on the skin, so it's essential to use it judiciously.

Propylene Glycol :

Propylene glycol is a synthetic compound often used in cosmetics and personal care products as a humectant, solvent, and preservative. In soap making, it can be added to increase lather and improve the texture of the soap. However, some people may have sensitivities to propylene glycol, so it's important to use it cautiously and consider potential allergic reactions.

Preparation of Glycerin Soap Base :

1. Measuring and Weighing Ingredients:

- Gather the following ingredients:
 - 40 ml water (H₂O)
 - 10 gm sodium hydroxide (NaOH)
 - 70 ml coconut oil
 - 30 gm stearic acid
 - 17 gm glycerin
 - 70 ml alcohol
 - 90 ml propylene glycol
- Make sure to measure accurately for consistent results.

2. Preparing the Lye Solution:

- In a well-ventilated area, carefully mix the sodium hydroxide (NaOH) with the water (H₂O). Always add the NaOH to the water, not the other way around.
- Stir until the NaOH is completely dissolved. This solution is your lye.

3. Mixing the Oils and Fats:

- Combine the coconut oil, stearic acid, glycerin, alcohol, and propylene glycol in a heat-resistant container.
- Heat the mixture gently until everything is melted and well-blended. You can use a double boiler or microwave for this step.

4. Combining the Oils and Lye Solution:

- Slowly add the lye solution to the melted oils and fats.
- Stir thoroughly to ensure proper mixing. The lye will react with the oils to create soap.

5. Blending and Mixing the Soap Base:

- Use a stick blender to blend the mixture. This helps emulsify the ingredients and promotes saponification.
- Continue blending until the mixture reaches a thick, pudding-like consistency (known as "trace").

6. Pouring and Curing the Soap Base:

- Pour the soap base into a mold of your choice. Silicone molds work well.
- Allow the soap base to cool and harden. This may take a few hours to overnight.
- Once solidified, remove the soap base from the mold and cut it into desired shapes.

7. Storage:

- Store your soap base in an airtight container or wrap it with cling film to prevent moisture absorption.



Figure No. 9 Prepared Glycerin Soap Base

METHODS

1. Prepare Bael Fruit Extract :

- Extract the pulp from ripe bael fruits and strain it to remove seeds and fibrous material.
- Blend or mash the pulp to create a smooth extract. You can add a small amount of water if needed to achieve a liquid consistency.
- Measure out the desired amount of bael fruit extract for your soap recipe.

2. Melt Glycerin Soap Base :

- Cut the glycerin soap base into small cubes for easier melting.
- In a double boiler or microwave-safe container, melt the glycerin soap base according to the manufacturer's instructions. If using a microwave, heat in short bursts, stirring frequently to avoid overheating.

3. Add Bael Fruit Extract :

- Once the glycerin soap base is fully melted, remove it from the heat source.
- Stir in the bael fruit extract gradually, mixing it thoroughly into the melted soap base. The amount of bael fruit extract added will depend on your preference for scent and color intensity.

4. Optional: Add Fragrance and Color :

- If desired, add a few drops of essential oils for fragrance.
- You can also add natural colorants like turmeric powder for a yellow hue. Start with a small amount and adjust until you achieve the desired color.
- Rose water has added in soap

5. Pour into Molds :

- Carefully pour the bael fruit-infused soap mixture into soap molds. Tap the molds gently on the countertop to release any air bubbles.



Figure No. 10 Mixture Poured in Mold

6. Allow to Cool and Set :

- Let the soap molds sit undisturbed until the soap has cooled and hardened completely. This typically takes a few hours, depending on the size and depth of the molds.

7. Unmold and Store :

- Once the soap has fully set, gently remove it from the molds.
- Store the bael fruit soap bars in a cool, dry place until ready to use. It's best to wrap them individually in wax paper or plastic wrap to prevent moisture loss and preserve the scent.

Evaluation of soap

The following Physico-chemical parameters were assessed for determining the quality of prepared formulation against marketed herbal Soap.

Physical parameters :

Colour: The colour of formulation was checked manually and observed.

Odour: The Smell of Formulation was checked by applying preparation on hand and feel the fragrance.

Appearance: Visually checked the appearance of the formulation.

pH :

The pH of the prepared soap was measured by digital pH meter. The prepared formulation was dissolved in 100 ml distilled water and kept for 2 h. pH measurement of the solution was done using a previously calibrated pH meter.

% free Alkali content :

The beaker containing 10g of dried soap was then filled with 150 ml of distilled water. To dissolve the soap, it was heated for 30 to 40 min at reflux on a water bath. This solution was cooled, transferred with the washings to the 250 ml conical flask, and the capacity was filled with distilled water. Two drops of the phenolphthalein indicator were added to 10 ml of the soap solution in the titration flask. The solution was then titrated against 0.1M HCl until it turned colorless.

Foam Retention :

A 25ml graduated measuring cylinder was filled with 10 ml of the one percent soap solution, then the cylinder was covered with a hand and shook ten times for 4 minutes, the volume of foam was measured at 1-minute intervals. it was discovered to be 5 minutes.

Volume of foam was measured to be 12 ml after 4 minutes and remained constant.

Moisture content

A sample of soap weighing 10g was weighed right away and noted as "wet weight of the sample." Using the appropriate drying equipment, this wet sample was dried to a constant weight at a temperature not to exceed 115 °C. After cooling, the sample was weighed once more to determine its "dry weight." The following equation was used to calculate the sample's moisture content.

$$\% \text{ Weight} = \frac{A-B}{B} \times 100$$

Where; % Weight = % of moisture in sample, A = weight of wet sample (gm), B = weight of dry sample (gm).

Alcohol insoluble matter

50 ml of warm ethanol was introduced to a conical flask containing a 5 gm sample of soap in order to dissolve it. Using tarred filter paper and 20 ml of warm ethanol, the liquid was filtered and then dried at 1050 C for an hour. The weighted filter paper had dried out.

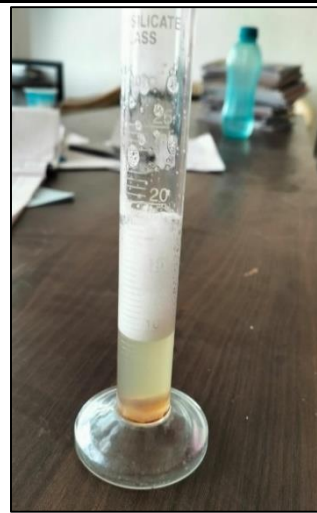
Results And Discussion

Physical Parameter : [Table No. 4]

Sr. No.	Parameter	Observation
1.	Colour	Dark Red
2.	Odour	Rosy
3.	Appearance	Good
4.	State	Solid
5.	Clarity	Crystal clear
6.	pH	7.4

Foamability : [Table No. 5]

Time (min.)	Foam Volume (ml)
0	19
1	18
2	17.5
3	16
4	15.5
5	14



Foam Height is 19

Figure No. 11 Foam Test

Moisture content & Alcohol insoluble matter : [Table No. 6]

Sr. No.	Parameter	Observation
1.	Moisture content (%)	3.26
2.	Alcohol insoluble matter	17.25



Figure No. 12 Prepared Bael Fruit Soap

Conclusion :

In conclusion, the formulation and evaluation of herbal soap using bael fruit represent a significant step towards the development of natural skincare products with potential therapeutic benefits. Bael fruit, renowned for its medicinal properties in traditional medicine, was successfully incorporated into a soap base through careful formulation techniques.

Throughout the study, various parameters including physical, pH, foamability and moisture content were meticulously evaluated. The results revealed that the herbal soap formulated with bael fruit extract exhibited promising characteristics. It maintained an appropriate pH level for skin health, produced a satisfactory lather, and demonstrated effective cleansing properties. Additionally, the soap showed minimal potential for skin irritation, indicating its safety and suitability for use on different skin types.

These findings underscore the potential of bael fruit as a valuable ingredient in natural skincare formulations. Not only does it offer cleansing benefits, but it may also provide additional therapeutic effects due to its bioactive compounds. Further research and development efforts could focus on optimizing the formulation to enhance its efficacy, stability, and consumer acceptance.

Overall, the formulation and evaluation of herbal soap using bael fruit offer a compelling avenue for the creation of innovative skincare solutions that harness the power of nature to promote skin health and well-being. With continued exploration and refinement, bael fruit-based herbal soap has the potential to make a significant impact in the skincare industry, catering to the growing demand for natural and sustainable products.

Summary :

The study on the formulation and evaluation of herbal soap using bael fruit aimed to explore the potential of incorporating this traditional medicinal plant into skincare products. Bael fruit, known for its therapeutic properties in traditional medicine, was utilized as a key ingredient in the soap formulation.

The researchers conducted a thorough process of extracting active constituents from bael fruit and integrating them into a soap base. This involved careful consideration of various parameters such as pH balance, lathering properties, cleansing efficacy, and potential for skin irritation.

Following the formulation process, the herbal soap underwent comprehensive evaluation to assess its performance and safety for use. Results indicated that the soap formulated with bael fruit extract exhibited promising characteristics. It maintained an optimal pH level suitable for skin health, produced a satisfactory lather during use, and demonstrated effective cleansing properties. Furthermore, the soap displayed minimal potential for causing skin irritation, indicating its safety profile for various skin types.

In summary, the formulation and evaluation of herbal soap using bael fruit offer an innovative approach to developing natural skincare products. The study highlights the potential of bael fruit as a valuable ingredient in skincare formulations, providing both cleansing benefits and potential therapeutic effects. Further research and optimization of the formulation could lead to the creation of effective and safe herbal soap products that cater to the growing demand for natural and sustainable skincare solutions.

REFERENCE

1. Kareru, P. G., Keriko, J. M., Gachanja, A. N., & Mukiira, H. N. (2010). Antimicrobial activities of skincare preparations from plant extracts. *African Journal of Traditional, Complementary and Alternative Medicines*, 7(3).
2. Bandyopadhyay, U., Biswas, K., Sengupta, A., Moitra, P., Dutta, P., Sarkar, D., ... & Banerjee, R. K. (2004). Clinical studies on the effect of Neem (*Azadirachta indica*) bark extract on gastric secretion and gastroduodenal ulcer. *Life sciences*, 75(24), 2867-2878.
3. Sharma, J., Gairola, S., Sharma, Y. P., & Gaur, R. D. (2014). Ethnomedicinal plants used to treat skin diseases by Tharu community of district Udham Singh Nagar, Uttarakhand, India. *Journal of ethnopharmacology*, 158, 140-206.
4. Nikita Prakash Gaikwad, Aditya S. Gaikwad & Pratibha S. Bhalerao, Formulation Development And Evaluation of Herbal Soap Containing Aegle marmelos fruit And *Azadirachta indica* : Antifungal Activity, *International Journal Of Pharmaceutical Sciences*, 2024; 2(4)
5. V.S. Tegeli, Sakshi P. Shete, Jahanara R. Shaikh, Megha A. Savaisarje, Sagar S. Satpute, Asad A. Sayyed, Formulation and Evaluation of Anti-acne Gel Cleanser using Bael Leaves Extract, *Research Journal of Topical and Cosmetic Sciences* 2022;13(2)
6. Singh, P., Dhanik, J., Mishra, A., & Srivastava, R. (2012). Bael: A potential fruit for food and medicine. *Journal of Pharmacognosy and Phytochemistry*, 1(1), 34-42.

7. Sneha Ashish Agrawal, Akshada Kadam, Shrutika Sonavale, Pratiksha Mulik, Formulation and Evaluation of Peel off Mask of Bael Fruit, International Journal of All Research Education and Scientific Methods (IJARESM), 2022; 10(8)
8. Singh, B., Singh, J. P., Kaur, A., Singh, N., & Kumar, S. (2011). Antioxidant activity of Aegle marmelos (L.) Correa (Bael) fruits extract. Food Research International, 44(5), 1271-1279.
9. Gupta, A., Kumar, S., & Pandey, R. (2017). A Review on Pharmacological and Phytochemical Properties of Bael Fruit (Aegle marmelos). World Journal of Pharmaceutical Research, 6(4), 227-240.
10. Sharma, A., Kumar, R., & Gupta, A. P. (2012). Aegle marmelos: A review on its medicinal properties. Journal of Medicinal Plants Research, 6(31), 4368-4374.
11. Chamila Kumari Pathirana, Terrence Madhujith And Janakie Eeswara, Bael (Aegle Marmelos L. Correa), A Medicinal Tree With Immense Economic Potentials, Hindawi Advances In Agriculture, 2020 : 1-13.
12. Tanmay Sarkar, Molla Salauddin, Runu Chakraborty, In-Depth Pharmacological And Nutritional Properties Of Bael (Aegle Marmelos): A Critical Review, Journal Of Agriculture And Food Research, 2020; 1-22.
13. Raturaj S. Gaikwad, Ashwini V. Khairnar, Sagar R. Jaiwal, Ajinath B. Gaikwad, Atul S. Chavan, An in-depth review on: formulation and evaluation of parts of aegle marmelos, world journal of pharmaceutical research, 2024; 13(3) : 247-271
14. Uttarwar VV, Taur AT and Sawate AR, Studies on evaluation of physicochemical and nutritional properties of bael fruit (Aegle marmelos), Journal of Pharmacognosy and Phytochemistry 2018; 7(3): 547-549
15. Patkar Atul N, Desai Nilesh V, Ranage Akkatai A, Kalekar Kamalakar S, A Review On Aegle Marmelos: A Potensial Medicinal Tree, International Research Journal Of Pharmacy, 2012 ; 3(8) : 86-91.
16. Lall, N., & Kishore, N. (2014). Herbal extracts in skincare: Botanical agents for the treatment of dermatological disorders. In N. Patel (Ed.), Herbal Medicine in India (pp. 415-443). Springer.
17. Manjunatha, B. K., Vidya, S. M., Rashmi, K. C., Mankani, K. L., Chandrashekar, K. T., & Shilpa, H. J. (2012). Topical herbal therapy for acne vulgaris: An overview. Natural Product Radiance, 11(1), 21-26.