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Original Article

Formulation and Evaluation of Anti- Bacterial Moringa Soap

Nalawade Mahesh[1], Anil Panchal*[2], Vishal Madankar[3]

[1]*Research Scholar, Department of Pharmaceutics, Delight College of Pharmacy, Koregaon Bhima, Pune, Maharashtra. India-412216.*
[2]*Assistant Professor Department of Pharmaceutics, Delight College of Pharmacy, Koregaon Bhima, Pune. Maharashtra, India-412216.*
[3]*Assistant Professor, Department of Quality Assurance Techniques, Delight College of Pharmacy, Koregaon Bhima, Pune, Maharashtra, India-412216.*

ABSTRACT

This study aims to formulate and evaluate moringa soap, utilizing the natural benefits of moringa oil, which is rich in antioxidants, vitamins, and essential fatty acids. The primary goal is to create a skin-care product that nourishes, moisturizes, and improves skin health. Moringa soap is prepared through the cold process method, incorporating moringa oil along with other natural ingredients to enhance its cosmetic and therapeutic properties. The rise of multidrug-resistant bacteria causing infections in humans is steadily increasing, while the development of new medications to counter this issue remains inadequate. Research has shown that Moringa oleifera Lamk possesses multiple medicinal properties, including antibacterial, antifungal, antispasmodic, anti-inflammatory, anticancer, and diuretic effects. As a result, herbal remedies could offer a potential approach to managing infections caused by multidrug-resistant bacteria. Staphylococcus aureus bacteria are commonly found as part of the normal skin flora, but when their numbers exceed the normal limit, they can lead to infection. To help prevent this, maintaining skin cleanliness by using soap with antibacterial agents, like flavonoids from Moringa leaves, is recommended. This study focuses on analyzing the flavonoid content, pH, Foaming Index and Foaming Height in Moringa leaves and incorporating it into transparent solid soap formulations. The soap was prepared with varying concentrations of Moringa leaf ethanol extract: 2.5%, 3.5%, and 4.5%.

Keywords: Moringa oleifera leaf, Antibacterial activity, Moringa soap, skin protection

INTRODUCTION

Microorganisms are present all around us and can lead to infections, such as those affecting the skin. These skin infections can be triggered by various types of microorganisms, including bacteria. Although bacteria naturally exist on the skin, an overgrowth of these bacteria can result in an infection. Staphylococcus aureus is one such bacterium that can cause skin infections in humans. This bacterium can be found on various objects like keyboards, wristbands, escalator handrails, and door handles. To prevent bacterial infections, it's important to maintain good personal hygiene, one way of which is by using cleansing products. Soap is a commonly used product for this purpose. Bath soap, which can be in solid, liquid, or foamy form, is a cosmetic product used for cleaning the skin. The effectiveness of bath soap in eliminating germs can be enhanced by incorporating antibacterial ingredients into its formulation. Natural antibacterial components for bath soap formulations can be sourced from the Moringa plant. Moringa leaves are rich in flavonoid compounds. one of which is quercetin. Quercetin has strong antibacterial properties. Considering the link between the flavonoids in Moringa leaves and their antibacterial potential, this study aims to analyze the flavonoid content in Moringa leaf extract and assess its incorporation into antibacterial transparent soap formulations.[1] Moringa oleifera, commonly known as the drumstick tree, miracle tree, or horseradish tree, is a highly valued plant native to the Indian subcontinent and widely cultivated across tropical and subtropical regions of the world. It belongs to the family

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Moringaceae and is renowned for its remarkable nutritional and medicinal properties. All parts of the plant including leaves, pods, seeds, flowers, and roots are utilized in various applications ranging from food and traditional medicine to agriculture and water purification.[2] The leaves of Moringa oleifera are especially notable for their high content of essential nutrients such as vitamins A, C, and E, calcium, iron, and protein. Due to its rich phytochemical composition, Moringa oleifera has been extensively studied for its antioxidant, anti-inflammatory, antimicrobial, and antidiabetic activities. As global interest in functional foods and natural remedies continues to rise, Moringa oleifera is gaining attention as a sustainable and multipurpose resource for combating malnutrition and promoting health.[3] Moringa, scientifically known as Moringa oleifera, is a fast-growing, drought-resistant tree native to the Indian subcontinent. It is commonly referred to as the "drumstick tree," "miracle tree," or "horseradish tree." Moringa is highly valued for its nutritional, medicinal, and economic benefits.[4] Every part of the plant leaves, pods, seeds, flowers, and even roots is edible and rich in nutrients. The leaves are particularly noted for their high content of vitamins (A, C, and E), minerals (especially calcium and iron), and proteins. Due to its health-promoting properties, moringa is widely used in traditional medicine and is gaining popularity globally as a superfood.[5]

Moringa

What is Moringa?
Scientific name: *Moringa oleifera*

Moringa is a fast-growing, drought-resistant tree native to the Indian subcontinent. It is widely grown in tropical and subtropical areas for its nutritious leaves, pods, seeds, and flowers.[6]

Nutritional Value

Moringa leaves are incredibly nutritious. Here's what they offer per 100g (fresh leaves):

- Protein: 9g (very high for a plant).
- Vitamin C: 200mg (more than oranges).
- Vitamin A: 6,780 IU (more than carrots).
- Calcium: 185mg (more than milk).
- Iron: 4mg (more than spinach).
- Potassium: 337mg.[7]

Health Benefits

1. Rich in Antioxidants Contains quercetin, chlorogenic acid, and beta-carotene, which help fight oxidative stress.
2. Anti-Inflammatory Properties Useful for reducing inflammation in chronic diseases like arthritis.
3. Blood Sugar Control Some studies show moringa can help lower blood sugar levels.
4. Cholesterol-Lowering Effects May reduce bad cholesterol (LDL) and improve heart health.
5. Brain Health Antioxidants and neuroprotective compounds may improve memory and mental clarity.
6. Antibacterial and Antifungal Effective against certain bacteria and fungi, supporting immune function.[8]

Fig 1: Moringa Powder

How to Use Moringa

- Fresh leaves: Cook like spinach in soups, stews, or stir-fries.

- Dried powder: Add to smoothies, tea, or sprinkle on food.
- Pods (drumsticks): Common in Indian curries.
- Seeds: Eaten roasted, or used for water purification.
- Oil (Ben oil): Used in cosmetics and cooking.[9]

Possible Side Effects

- High doses may cause nausea or diarrhoea.
- Pregnant women should avoid moringa root and bark (can cause uterine contractions).
- Always consult with a healthcare provider before taking it as a supplement.[10]

Global Uses

- India: Used in Ayurvedic medicine for over 5,000 years.
- Africa: Grown in dry regions for food security and malnutrition.
- Philippines and Southeast Asia: Common in soups and health tonics.[11]

CAUSES AND RISK FACTORS

1. Overconsumption

I. Taking too much moringa powder or extract can lead to digestive problems like nausea, vomiting, and diarrhoea.

II. Excess intake of iron and calcium from concentrated powder may stress the kidneys in vulnerable people.

2. Consuming Toxic Parts of the Plant

I. Roots and bark contain Spiro chin, a potentially toxic alkaloid that may cause nerve paralysis or miscarriage.

II. Moringa root extract has been linked to harmful effects in animal studies.

3. Contaminated Products

I. Poorly processed or stored moringa supplements may be contaminated with bacteria, heavy metals, or pesticides.

II. Risk is higher with unregulated or imported supplements.

4. Drug Interactions

I. Moringa may interact with:

a. Blood pressure medications (can cause too-low blood pressure).
b. Diabetes medications (can dangerously lower blood sugar).
c. Thyroid medications.[12]

Risk Factors for Experiencing Side Effects

You are more at risk of adverse effects if you:

Risk Factor	Why it Matters
Pregnant or Breastfeeding	Moringa root and bark may cause uterine contractions or toxicity to the baby.
Taking Medications	Moringa can alter how drugs for diabetes, hypertension, and thyroid are metabolized.
Pre-existing Liver or Kidney Disease	High concentrations of minerals and bioactive compounds may burden these organs.
Using Concentrated Extracts	These are much more potent than food forms and can cause stronger side effects.
Children under 2 years	Their developing systems are more sensitive to plant compounds and dosing is unclear.[13]

Safety Tips

- Use leaves and pods, not root or bark.
- Start with small amounts (1 tsp of powder daily).
- Choose reputable brands with quality testing.
- Talk to your doctor or pharmacist if you're on medication.
- Avoid during pregnancy unless advised by a health professional.[14]

Plant Profile

Moringa leaves

Moringa leaves are the foliage of the Moringa oleifera tree, often referred to as the "drumstick tree" or "miracle tree." These leaves are highly nutritious and are widely used in traditional medicine and cuisine, especially in Asia and Africa.[15]

Fig 2: Moringa leaf

Plant Detail

1. Synonyms: moringa oleifera

2. Kingdom: Plantae.

3. Order: Brassicales

4. Family: Moringaceae

5. Genus: Moringa

6. Species: Moringa oleifera

7. Botanical name: moringa oleifera

8. Chemical constituents: alkaloids, flavonoids, phenolic compound, glycoside, tannins, saponin.

9. Uses: anti-inflammatory, antioxidant, anti-hypertensive, antimicrobial.

10. Biological Source: It is various part of plant are used, including the leaves, seed, pods, flowers, roots and barks.

11. Geographical source: Moringa oleifera, commonly known as the drumstick tree or miracle tree, is native to the sub-Himalayan regions of northern india.[16]

Benefits of Moringa:

1) Anti-Inflammmatory.
2) Antioxidant Properties.
3) Blood Sugar Regulation.
4) cholesterol Reduction.
5) Supports Heart Health.
6) Antimicrobial and Antibacterial.[17]

METHODOLOGY

A. Material

Collection of Plant material:

Moringa that were identified and collected from the Koregaon Bhima, Pune. Maharashtra, India-412216 neighborhood. The Moringa was cleaned, dried in room temperature, transfer into moderately coarse powder and stored in well closed container before the extraction.

Preparation of Moringa Extract:

1. Collection and Drying of Leaves

- Fresh Moringa oleifera leaves are collected.
- Washed thoroughly with distilled water to remove dirt.
- Dried in shade or an oven at 40–50°C until moisture is removed.

2. Grinding

- The dried leaves are ground into a fine powder using a mechanical grinder or mortar and pestle.

3. Extraction (Solvent-Based Method)

- Aqueous Extraction (Water-Based):
- Mix 10–20 g of moringa powder with 100–200 mL of distilled water.
- Heat at 60–70°C for 30–60 minutes.
- Cool, filter using Whatman filter paper.
- Store the extract at 4°C for further use.

4.Ethanolic or Methanolic Extraction:

- Mix moringa powder with ethanol or methanol in a 1:10 ratio (e.g., 20 g in 200 mL solvent).
- Shake on a rotary shaker or stir continuously for 24–48 hours.
- Filter and evaporate the solvent using a rotary evaporator or under reduced pressure.
- Store the residue (crude extract) in airtight containers.

5. Concentration and Storage:

- Concentrated extracts can be lyophilized (freeze-dried) for long-term storage.
- Store in a cool, dry place or at 4°C if in liquid form.

The figure shows how extraction process will conduct:

Fig 3: Moringa Extraction

Table 1: Method for the Preparation of Moringa

Sr. No.	Ingredient	Quantity (for 100 gm)	Role
1	Soap Base	60 ml	Cake Formation.
2	Moringa leaves Extract	10 ml	Anti-inflammatory.
3	Citrus Sinensis Peel Powder	0.004 ml	Vitamin C.
4	Cinnamon Zeylanicum Bark Extract	1ml	Skin Whitening agent.
5	Sapindus Mukorosissi Powder	0.0005ml	Natural Body Cleanser.
6	Glycerine	10 ml	Moisturizing Properties.
7	Sodium lauryl Sulphate	0.01ml	Foaming agent.
8	Distilled water	19 ml	Vehicles.

Preparation Method:

1)Take 60 ml of soap base in a beaker and put on water bath at 45°C

2) Then add the all ingredient (M. oleifera leaves extract, C. sinensis peel powder, C. zeylanicum bark extract, S. mukorosissi powder and glycerine, SLS, Water, Soap Base) with continuous stirring in to soap base.

3) Boil the mixture on the water bath at 45°C and soap mixture is prepared.

4) Prepared soap mixture is filled in soap moulds and mould is put in the refrigerator for 15 minutes

5) After solidification cut the soap mould using cutter or blade.

6)Then obtained moringa soap.

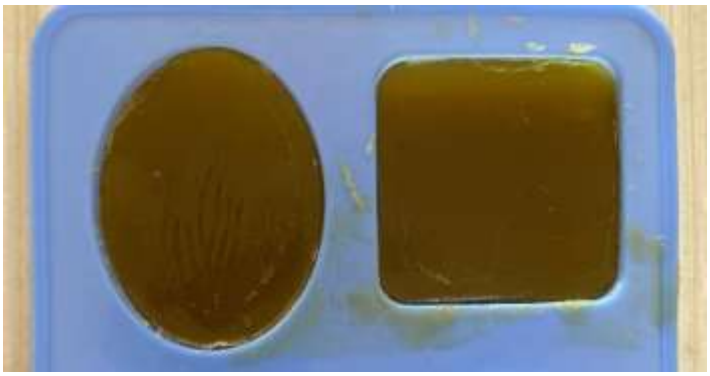

Fig.4: Moringa Soap

Evaluation Parameters for Moringa Soap **1. Physical Parameters**

Table.2. Result and Observation of Physical Parameter

Parameter	Method	Observation	Result
colour	Visual inspection	Light green	Acceptable
texture	Touch /feel	smooth	Acceptable
Shapes and size	Ruler /scale	uniform	Acceptable
Lathering ability	Water+hand agitation	Rich lather in 10 sec	Good
hardness	Manual press	Firm, does not dent easily	Satisfactory

2.Chemical Evaluation

Table.3. Result and Observation of Chemical test

Parameter	Test method	Result	Standard Range	Conclusion
PH	Ph meter	8.1	7-9	Within limits
Moisture content	Oven drying method	12.5	< 15 %	acceptable
Total fatty matter	Gravimetric method	74.2	>70%	Good quality
Free alkali	titration	0.05	<0.1%	Safe of skin

3. Foaming Index

Procedure:

1. Label 4 test tubes from 1 to 4.
2. In test tube 1, add 1 mL of soap solution + 9 mL distilled water (1:10 dilution).
3. Repeat with each tube using serial dilution until test tube 4 (1:10,000).
4. Shake each test tube vigorously for 15 seconds.
5. Let all tubes stand for 5 minutes.
6. Measure the height of the foam (in mm) for each tube.

Table.4. Sample Result Table

Test Tube No.	Dilution	Foam Height (cm)
1	1:10	3
2	1:100	6
3	1:1000	9
4	1:10,000	11

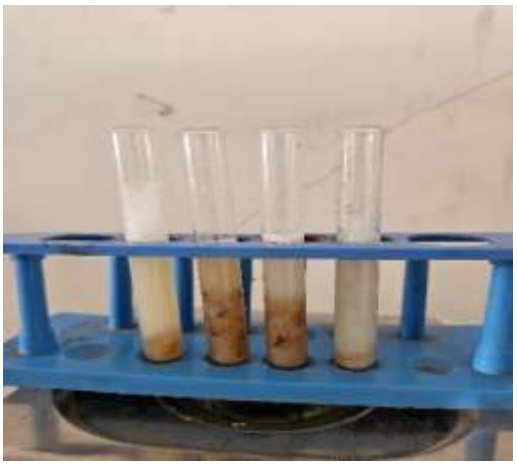

Fig 5: Foaming Index

4. Microbiological Evaluation

Test	Method	Result	Standard Limit	Conclusion
Total Viable Count	Plate Count Agar	10^2	$<10^3$	Passed
Fungal Count	Sabouraud Dextrose	Not Detected	$<10^2$	Passed

5. Stability Test (30 Days)

Storage Condition	Observation after 30 days	Result
Room Temperature	No change in texture or scent	Stable
High Temperature	Slight scent fade, no softening	Acceptable
Refrigerated	No change	No change

RESULTS AND DISCUSSION

The soap sample underwent a series of evaluation tests to assess its physical, chemical, foaming, microbiological, and stability characteristics. Physically, the soap exhibited a light green color, smooth texture, and uniform shape and size. It produced rich lather within 10 seconds upon hand agitation, and showed firm hardness without denting easily—indicating a high-quality formulation. Chemically, the pH was measured at 8.1, which falls within the safe range of 7–9. The moisture content was found to be 12.5%, well below the maximum permissible limit of 15%, while the total fatty matter (TFM) was 74.2%, signifying good cleansing and skin-conditioning properties. The free alkali content was 0.05%, which is below the 0.1% limit, confirming the product is safe for skin contact. The foaming index test, conducted through serial dilution, showed increasing foam height with higher dilution levels—from 3 cm at 1:10 to 11 cm at 1:10,000—demonstrating excellent foaming ability. Microbiologically, the soap passed safety standards, with a total viable count of 102 CFU/g (within the $<10^3$ limit) and no fungal growth detected, ensuring the product is free from harmful microbial contamination. In a 30-day stability test, the soap remained unchanged in texture and scent at room temperature and under refrigeration. Only a slight scent fade was observed under high-temperature storage, but no softening occurred, deeming it acceptable. Overall, the soap sample met all quality standards and can be considered stable, safe, and effective for consumer use.

CONCLUSION

The formulated antibacterial Moringa soap demonstrated promising physical, chemical, and microbiological characteristics. The soap exhibited an appealing appearance, acceptable pH suitable for skin application, and good foaming ability, indicating

effective cleansing properties. Stability studies confirmed that the formulation remained consistent under various storage conditions without significant changes in texture, color, or efficacy. Furthermore, microbiological evaluation showed that the soap was free from harmful microorganisms and exhibited strong antibacterial activity, attributed to the bioactive compounds present in Moringa oleifera. These findings suggest that the Moringa-based soap is a stable, safe, and effective natural antibacterial product suitable for regular hygiene use.

FUTURE SCOPE

The formulation and evaluation of antibacterial moringa soap offer promising potential for future development and commercialization. As consumers increasingly shift toward natural and herbal products, moringa (Moringa oleifera), known for its potent antimicrobial, antioxidant, and skin-nourishing properties, presents a valuable ingredient in cosmetic and personal care formulations. Future research can explore optimizing extraction techniques to enhance the concentration of bioactive compounds in the soap. Additionally, advanced formulation methods could improve soap stability, shelf life, and efficacy. Clinical studies and broader microbiological evaluations can validate its antibacterial performance against a wider range of pathogens. There is also scope for scaling up production, developing eco-friendly packaging, and expanding product lines to include moringa-based body washes, face cleansers, and hand sanitizers. Furthermore, combining moringa with other complementary herbal extracts could lead to synergistic effects and more effective multifunctional skincare products.

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