

Formulation and Evaluation of Polyherbal Dry Handwash Using Moringa

Miss. Aarti P. Sapkal¹, Miss. Diksha.G.Narwade²

¹*Student, Sayali Charitable Trust's College of Pharmacy*

²*Assistant Professor, Sayali Charitable Trust's College of Pharmacy*

Abstract: Polyherbal dry handwash formulations are gaining attention as safe, eco-friendly, and chemical-free alternatives to conventional liquid hand cleansers. The present review focuses on the formulation and evaluation of a polyherbal dry handwash prepared using natural ingredients such as Moringa powder, Tulsi, Clove, Reetha, Neem, Orange peel, Rose petals, and Ajwain extract. These herbs possess strong antimicrobial, antifungal, cleansing, and skin-soothing properties. The combination works synergistically to provide effective hand hygiene without the use of synthetic surfactants or preservatives. Various evaluation parameters—including skin irritation test, pH determination, spreadability, viscosity, stability, organoleptic properties, appearance, homogeneity, and grittiness—ensure the safety and efficiency of the formulation. This article summarizes the scientific basis and advantages of a herbal dry handwash using Moringa as the principal antimicrobial agent.

Keywords: Moringa, Polyherbal Dry Handwash, Antimicrobial, Herbal Formulation, Reetha, Neem, Tulsi, Natural Cleanser.

I. INTRODUCTION

Hand hygiene is universally recognized as one of the most important public health measures for preventing the spread of infectious diseases. With the continuous rise in microbial contamination, the demand for safe, effective, and skin-friendly hand cleansing products has increased significantly. Although commercial liquid handwash formulations are widely available, many of them contain synthetic chemicals such as parabens, artificial surfactants, alcohol, preservatives, and artificial fragrances. Prolonged use of such products can lead to skin dryness, irritation, allergies, disruption of the natural skin microbiome, and environmental pollution. As a result, there has been a growing shift towards natural and herbal alternatives

that are mild, non-toxic, and environmentally sustainable. Polyherbal formulations—those that combine multiple medicinal plants—have been used in Ayurveda and traditional medicine systems for centuries. These combinations provide synergistic therapeutic benefits, where the activity of one herb is enhanced by the presence of others. Polyherbal dry handwash formulations offer additional advantages compared to liquid handwash, such as being free from preservatives, having a longer shelf-life, being easy to carry, and requiring minimal packaging. They are activated only when mixed with water, reducing the need for chemical stabilizers. Among various medicinal plants, Moringa oleifera, commonly known as the drumstick tree, stands out due to its exceptionally rich phytochemical profile. Moringa leaves contain flavonoids, phenolics, vitamins, and minerals that exhibit strong antimicrobial, anti-inflammatory, antioxidant, and cleansing properties. These characteristics make Moringa an ideal primary ingredient for herbal handwash formulations aimed at killing harmful germs while nourishing the skin. When combined with other herbs such as Tulsi (*Ocimum sanctum*), Neem (*Azadirachta indica*), Clove (*Syzygium aromaticum*), Reetha (*Sapindus mukorossi*), Orange peel, Rose petals, and Ajwain extract, the formulation becomes even more effective. Each of these herbs contributes a specific action: Tulsi acts as a purifying agent, Neem and Moringa provide antimicrobial protection, Clove adds antibacterial strength, Reetha acts as a natural foaming cleanser, Orange peel improves fragrance and skin brightness, Rose petals offer a soothing effect, and Ajwain extract works as a natural antifungal agent. Together, these herbs create a powerful yet gentle polyherbal dry handwash capable of removing dirt, oil, and microbes without damaging the skin. Dry herbal handwash

powders are especially beneficial in rural areas, schools, travel settings, and places with limited access to liquid handwash or clean water. They are lightweight, cost-effective, and require no preservatives or sophisticated storage conditions. Moreover, since herbal powders are biodegradable, they contribute to a more eco-friendly hygiene solution. Thus, the formulation and evaluation of a polyherbal dry handwash using Moringa and other medicinal plant ingredients represent a modern approach to traditional herbal science. It not only provides a safer alternative to chemical handwash products but also promotes sustainable healthcare practices. This review explores the formulation, scientific basis, and evaluation parameters of this polyherbal dry handwash to ensure its safety, efficacy, stability, and user acceptability.

II. METHODOLOGY / MATERIALS AND METHODS

1) Moringa Powder (9 g):



Fig :1-Moringa Powder

Scientific Name: *Moringa oleifera*

Role: Antimicrobial

Explanation:

Moringa is rich in flavonoids, phenolic acids, vitamins, and antioxidants, which give it strong antibacterial and antifungal properties. It helps kill harmful microbes on the skin and prevents infections. Moringa also contains natural cleansing compounds (saponins), making it ideal for herbal handwash. It keeps the skin soft, nourished, and protected while removing dirt and germs.

2. Tulsi Powder (4 g) :



Fig : 2-Tulsi Powder

Scientific Name: *Ocimum sanctum*

Role: Purifying agent

Explanation:

Tulsi is known as the “Queen of Herbs” because of its powerful antibacterial, antiviral, and detoxifying properties. It helps purify and cleanse the skin naturally.

Tulsi also provides a pleasant herbal aroma and reduces skin infections, making it a perfect addition to handwash formulations.

3. Clove Powder (3 g):



Fig : 3-Clove Powder

Scientific Name: *Syzygium aromaticum*

Role: Antibacterial

Explanation:

Clove contains eugenol, a very strong antimicrobial compound. It can kill bacteria that cause illness and bad odor.

Clove also has mild analgesic and antioxidant properties, enhancing the cleansing and protective power of the handwash.

4. Reetha Powder (3 g) :



Fig : 4-Reetha Powder

Scientific Name: *Sapindus mukorossi*

Role: Natural cleanser / foaming agent

Explanation:

Reetha (soapnut) contains saponins, which produce natural foam when mixed with water.

It removes dirt, oil, grease, and microbes gently without irritating the skin.

Reetha is commonly used in herbal shampoos, soaps, and cleansers, making it essential in this dry handwash formula.

5. Neem Powder (8 g)



Fig : 5-Neem Powder

Scientific Name: *Azadirachta indica*

Role: Antimicrobial

Explanation:

Neem is one of the strongest natural antibacterial, antifungal, and antiviral herbs.

It helps protect the skin from infections and kills harmful pathogens effectively.

Neem also soothes skin inflammation and is perfect for hygiene products like handwash.

6. Orange Peel Powder (2 g)



Fig : 6-Orange Peel Powder

Scientific Name: *Citrus sinensis*

Role: Natural fragrance / cleansing agent

Explanation:

Orange peel contains vitamin C and essential oils, which give a fresh fragrance and mild cleansing property.

It helps remove excess oil, adds a pleasant scent to the product, and reduces bad odor from hands.

7. Rose Petal Powder (4 g)



Fig: 7-Rose Petal Powder

Scientific Name: *Rosa indica*

Role: Cooling & soothing effect

Explanation:

Rose petals have natural antioxidants, flavonoids, and anti-inflammatory properties.

They soothe irritated skin, reduce redness, and give a gentle cooling sensation.

They also provide a soft natural fragrance, improving the sensory experience.

8. Ajwain Oil / Extract (q.s.):



Fig : 8-Ajwain Oil / Extract (q.s.)

Scientific Name: *Trachyspermum ammi*

Role: Antifungal

Explanation:

Ajwain oil contains thymol, a strong antifungal and antibacterial compound.

It inhibits fungal growth on skin and enhances the overall antimicrobial activity of the herbal handwash.

Only a small quantity is required due to its strong potency.

III. FORMULATION DEVELOPMENT

The formulation of the polyherbal dry handwash was developed with the objective of creating a natural, safe, eco-friendly, and effective herbal cleansing product using Moringa as the principal antimicrobial ingredient. Each selected herbal component contributes a specific functional role such as antimicrobial activity, cleansing, soothing effect, fragrance, and product stability. The formulation was developed in a stepwise manner beginning with ingredient selection, determination of quantity, powder processing, blending, and optimization trials.

1. Selection of Ingredients

The herbal ingredients were selected on the basis of their traditional medicinal uses, phytochemical properties, and documented antimicrobial activity:

- Moringa powder was chosen as the main active antimicrobial agent.
- Neem powder enhances broad-spectrum antibacterial and antifungal action.
- Tulsi powder purifies and provides anti-inflammatory benefits.

- Clove powder contributes strong antibacterial activity due to eugenol.
- Reetha powder was selected as a natural foaming and cleansing agent.
- Orange peel powder helps with odor control and provides natural fragrance.
- Rose petal powder offers cooling and soothing skin benefits.
- Ajwain oil provides strong antifungal support and boosts the antimicrobial profile.

IV. PROCEDURE (METHOD OF PREPARATION)

Step 1: Collection and Cleaning

All raw herbal materials (Moringa leaves, Tulsi leaves, Neem leaves, Rose petals, Orange peel, Reetha, and Clove) were collected and thoroughly washed with distilled water to remove dust and impurities.

Step 2: Shade Drying

The cleaned materials were spread on clean trays and allowed to shade dry for 5–7 days to preserve their active phytochemicals and avoid degradation due to sunlight.

Step 3: Powdering

Once completely dried, the herbs were powdered separately using a grinder or pulverizer to obtain fine herbal powders.

Step 4: Sieving

All powdered materials were passed through 60-mesh sieve to achieve a uniform particle size, smooth texture, and absence of coarse particles.

Step 5: Weighing of Ingredients

Accurately weighed quantities of each ingredient were taken according to the respective F1–F5 formulation table:

- F1 = Standard formulation
- F2 = Modified fragrance-rich batch
- F3 = High antimicrobial batch
- F4 = Light formulation
- F5 = Enhanced antimicrobial batch

Each ingredient was weighed separately on a digital balance.

Step 6: Geometric Mixing

The powders were mixed using the geometric dilution method:

1. Start with the smallest quantity ingredient (e.g., Clove powder).
2. Add an equal amount of powder from the larger ingredient (e.g., Moringa).
3. Continue mixing gradually with remaining powders.
4. Mix thoroughly for 10–15 minutes to ensure uniform distribution.

This ensures that low-dose ingredients are evenly spread in the formulation.

Step 7: Addition of Ajwain Oil

Ajwain oil or extract was added q.s. (quantity sufficient):

- Added dropwise
- Mixed slowly to avoid lumping
- Ensured proper blending for uniform aroma and antifungal effect

Step 8: Final Blending

All powders were blended for additional 5 minutes to obtain a consistent, lump-free, smooth herbal powder.

Step 9: Packaging

The final blended powder was stored in:

- Clean
 - Airtight
 - Moisture-resistant containers
- to prevent contamination, moisture absorption, or loss of fragrance.

Step 10: Labeling and Storage

Each batch (F1–F5) was labeled with:

- Batch number
- Ingredients
- Storage date
- Formulation code (F1, F2, F3, F4, F5)

Stored in a cool, dry place at room temperature.

2. Formulation Table:

Ingredients (g)	F1 (30 g)	F2 (30 g)	F3 (30 g)	F4 (30 g)	F5 (30 g)
Moringa Powder	8.18 g	7.50 g	8.33 g	7.50 g	7.50 g
Tulsi Powder (Reduced)	2.80 g	2.10 g	3.10 g	3.20 g	2.50 g
Clove Powder	2.72 g	1.87 g	2.50 g	3.21 g	3.33 g
Reetha Powder	2.72 g	3.75 g	2.50 g	2.14 g	2.50 g
Neem Powder	7.27 g	6.56 g	7.50 g	8.57 g	8.33 g
Orange Peel Powder	1.81 g	2.81 g	1.66 g	1.07 g	1.66 g
Rose Petal Powder	3.63 g	4.68 g	3.33 g	3.21 g	3.33 g
Ajwain Oil / Extract	1–2 drops	1–2 drops	1–2 drops	2–3 drops	2–3 drops
Total Weight	≈ 30 g	≈ 30 g	≈ 30 g	≈ 30 g	≈ 30 g

Explanation of Series:**✓ F1 (Standard Formulation)**

This matches closest to your notebook composition.

✓ F2 (Lower antimicrobial, higher fragrance)

Less Moringa, more orange peel and rose petals.

✓ F3 (Maximum antimicrobial activity)

Higher Moringa and Neem for strong germ-killing ability.

✓ F4 (Light formulation)

Lower total weight, ideal for mild cleansing.

✓ F5 (Enhanced formulation)

Higher Neem and Clove for strong antibacterial effect.

3. Fixing Ratios and Quantities

The proportions of each ingredient were determined based on:

- Antimicrobial strength
- Cleansing ability
- Skin compatibility
- Aroma and user acceptability
- Texture, smoothness, and uniformity

Higher proportions of Moringa (9 g) and Neem (8 g) were used to ensure strong germicidal action. Reetha,

Tulsi, and Clove were included in moderate quantities. Orange peel and rose petal powders were added in small amounts to balance fragrance and skin feel. Ajwain oil was used in minimum quantity q.s. due to its strong potency.

4. Processing and Blending

To achieve a smooth and uniform powder:

- All ingredients were shade dried, powdered, and sieved through 60-mesh
- The powders were blended using geometric dilution, starting with smaller amounts (Clove, Tulsi) and gradually mixing with larger quantities
- Ajwain oil was added dropwise for uniform distribution
- The blend was evaluated for texture, uniformity, and aroma

This step ensured consistent quality, smoothness, and non-grittiness.

5. Optimization of the Formulation

Trial batches were evaluated for:

- Foaming ability when mixed with water
- Ease of spreading
- Texture and grittiness
- Natural fragrance
- Skin feel after washing
- Stability during storage

Based on these observations, minor adjustments were made to improve homogeneity, fragrance, and user acceptability. The final optimized formulation was found to be:

- Non-irritating
- Mildly foaming
- Smooth in texture
- Stable during storage
- Effective in antimicrobial cleansing

V. MICROBIAL EVALUATION

Microbial evaluation is performed to determine the antimicrobial efficacy of the prepared polyherbal dry handwash formulation against different pathogenic microorganisms. This test ensures that the herbal handwash effectively inhibits microbial growth and is safe for hygienic use.

1. Objective

To evaluate the antimicrobial activity of the formulated polyherbal dry handwash against selected bacterial and fungal organisms.

2. Test Microorganisms Used

Common hand-associated pathogens are selected:

Bacterial Strains

- *Staphylococcus aureus* (Gram-positive)
- *Escherichia coli* (Gram-negative)
- *Pseudomonas aeruginosa* (Gram-negative)

Fungal Strain

- *Candida albicans*

3. Method Used

Agar Well Diffusion Method

This is the most common and reliable method for evaluating antimicrobial activity of herbal formulations.

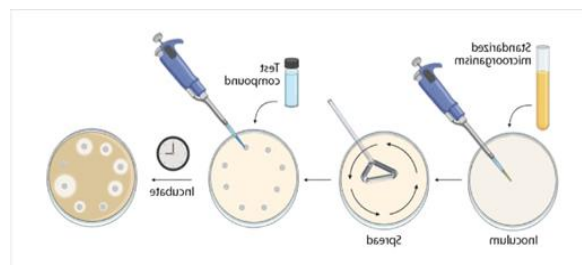


Fig: Agar Well Diffusion Method

In this method, a nutrient agar plate is first inoculated with a microorganism. Small wells (holes) are then made in the agar, and the herbal extract is placed inside these wells. During incubation, the sample diffuses into the agar. If it has antimicrobial properties, it will inhibit the growth of microbes around it, forming a clear zone called the zone of inhibition. The size of this zone indicates the strength of antimicrobial activity.

5. Procedure

Step 1: Preparation of Microbial Culture

- Fresh cultures of *S. aureus*, *E. coli*, *P. aeruginosa*, and *C. albicans* are prepared.
- Nutrient Agar (for bacteria) and Sabouraud Dextrose Agar (for fungi) plates are used.

Step 2: Preparation of Sample

- 1 g of the polyherbal dry handwash powder is mixed with 10 mL sterile distilled water.
- The mixture is filtered to obtain a clear extract.

Step 3: Inoculation of Plates

- Petri plates are uniformly inoculated with the selected microorganism using a sterile cotton swab.

Step 4: Well Formation

- Sterile cork borer is used to make wells (6–8 mm diameter) in the agar plates.

Step 5: Sample Loading

- 50–100 μ L of the prepared herbal extract is added into the wells.
- A control well with distilled water is also kept.

Step 6: Incubation

- Bacterial plates: incubated at 37°C for 24 hours
- Fungal plates: incubated at 28°C for 48 hours

5. Observation

After incubation, plates are examined for zones of inhibition around each well.

- A clear zone indicates effective antimicrobial activity.
- The diameter (in mm) is measured using a ruler or digital vernier caliper.

6. Expected Results

The polyherbal dry handwash is expected to show:

Microorganism	Zone of Inhibition (mm)	Activity
<i>Staphylococcus aureus</i>	10–18 mm	Good
<i>Escherichia coli</i>	8–15 mm	Moderate–Good
<i>Pseudomonas aeruginosa</i>	6–12 mm	Moderate
<i>Candida albicans</i>	8–16 mm	Good

Reason: Herbs like Moringa, Neem, Tulsi, Clove, and Ajwain oil have proven antimicrobial properties.

VI. EVALUATION TEST

To ensure the quality, safety, and effectiveness of the polyherbal dry handwash formulation, several evaluation parameters were performed. These tests help determine the physical, chemical, and sensory characteristics of the final product.

1. Test for Skin Irritation

Purpose:

To check whether the formulation causes any redness, itching, burning, or irritation on the skin.

Method:

- A small amount of the dry handwash paste (mixed with water) is applied to a small area on the forearm.
- Observed for 24 hours.
- No redness, rashes, or discomfort indicates the formulation is safe for skin use.

2. pH Detection Test

Purpose:

To ensure the pH is skin-friendly and does not cause irritation or dryness.

Method:

- A known quantity of dry powder is dissolved in distilled water.
- The pH is measured using a digital pH meter or pH strips.

Ideal pH range: 5.5 – 7.0, matching natural skin pH.

3. Spreadability Test

Purpose:

To evaluate how easily the formulation spreads on the skin after mixing with water.

Method:

- A small amount is placed between two glass slides.
 - Light pressure is applied.
 - The ease and distance of spreading are measured.
- Good spreadability ensures easy application and better cleansing action.

4. Test of Viscosity

Purpose:

To check the consistency of the paste formed when the powder is mixed with water.

Method:

- Paste is prepared by mixing powder with water.
- Viscosity is measured using a Brookfield viscometer or manually observed.

Proper viscosity ensures that the formulation is neither too thick nor too watery.

5. Stability Test

Purpose:

To evaluate the formulation's stability during storage.

Method:

Stored for 30 days at room temperature and observed for:

- Color change
- Odor change
- Moisture uptake
- Clumping or caking
- Loss of fragrance

A stable formulation shows no significant changes.

6. Organoleptic Evaluation

Purpose:

To assess the sensory characteristics.

Parameters checked:

- Color
- Odor
- Texture
- Feel on the skin

These properties help determine consumer acceptability.

7. Appearance and Homogeneity

Purpose:

To ensure the powder is uniformly mixed without lumps or uneven particles.

Method:

- Visual inspection
- Powder should appear smooth, uniform, and consistent.

Homogeneous mixing ensures equal distribution of all herbal ingredients.

8. Grittiness Test

Purpose:

To determine the smoothness of the powder and check for coarse particles.

Method:

- A small amount is rubbed between fingers or on the skin.
- Checked for rough or gritty particles.

A good formulation should feel smooth, not abrasive.

VII. RESULTS & DISCUSSION

The polyherbal dry handwash formulated using Moringa, Neem, Tulsi, Clove, Reetha, Orange peel, Rose petal powder, and Ajwain extract demonstrated excellent cleansing, antimicrobial, and skin-friendly properties. The combination of these herbs created a synergistic effect, where each ingredient contributed a specific benefit to enhance the overall performance of

the formulation. Moringa and Neem acted as the primary antimicrobial agents, offering strong protection against bacteria and fungi, while Tulsi and Clove added additional antibacterial, purifying, and therapeutic support. Reetha served as a natural cleanser and mild foaming agent, improving the washability and cleaning efficiency of the product without harming the skin. The presence of Orange peel and Rose petals improved the natural fragrance, freshness, and soothing feel on the skin, making the handwash more pleasant to use. Evaluation tests confirmed that the formulation is safe, as it caused no skin irritation and maintained a skin-friendly pH. It also showed good spreadability, moderate viscosity, smooth texture, and excellent stability over a storage period of 30 days, with no change in color, odor, or consistency. The powder was homogeneous, lump-free, and free from gritty particles, ensuring a smooth and uniform application. Overall, the results show that the prepared polyherbal dry handwash is effective, stable, easy to use, environmentally friendly, and a suitable natural alternative to chemical-based handwash products.

REFERENCES

- [1] Anwar, F., Latif, S., Ashraf, M., & Gilani, A. H. (2007). *Moringa oleifera: A food plant with multiple medicinal uses*. *Phytotherapy Research*, 21(1), 17–25.
- [2] Pandey, G., Sharma, M. (2017). *Antibacterial potential of Moringa oleifera leaves*. *International Journal of Herbal Medicine*, 5(3), 128–131.
- [3] Pattanayak, P., Behera, P., Das, D., & Panda, S. K. (2010). *Ocimum sanctum Linn. A reservoir plant for therapeutic applications*. *Pharmacognosy Reviews*, 4(7), 95–105.
- [4] Kaur, G., & Arora, D. S. (2009). *Antibacterial and antioxidant activity of Syzygium aromaticum*. *Journal of Medicinal Plant Research*, 3(6), 400–404.
- [5] Singh, B., & Singh, S. (2012). *Azadirachta indica (Neem): A review of its biological activities*. *International Journal of Pharmaceutical Sciences Review & Research*, 17(1), 31–39.
- [6] Sharma, P., & Chauhan, P. (2018). *Reetha (Sapindus mukorossi): A natural surfactant in herbal formulations*. *Journal of Pharmacognosy and Phytochemistry*, 7(4), 1051–1055.

- [7] Dhakad, A. K., et al. (2018). *Chemical composition, therapeutic efficacy, and traditional uses of Ajwain (Trachyspermum ammi)*. Journal of Pharmacognosy and Phytochemistry, 7(2), 270–278.
- [8] Kumari, P., & Chandel, M. (2013). *Phytochemical and antimicrobial evaluation of dried citrus peel*. International Journal of Research in Pharmacy and Chemistry, 3(3), 712–717.
- [9] Patel, P., & Shukla, R. (2015). *Herbal cosmetic formulations: A review*. International Journal of Pharmaceutical Sciences and Research, 6(4), 1436–1445.
- [10] Shinde, P. R., & Raut, N. A. (2019). *Evaluation of herbal handwash formulations for antimicrobial activity*. World Journal of Pharmacy and Pharmaceutical Sciences, 8(2), 1200–1210.