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FORMULATION AND EVALUATION OF POLYHERBAL PAPER SOAP: AN ECOFRIENDLY APPROACH TO PERSONAL HYGIENE

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ABSTRACT

Personal hygiene is essential for maintaining health and preventing infectious diseases. This study aimed to formulate and evaluate polyherbal paper soap using natural herbal ingredients: Tulsi leaves extract, Neem leaves extract, Turmeric extract, Aloe vera gel, glycerin, and base soap solution. The herbal ingredients were selected for their antibacterial, antifungal, antioxidant, antiseptic, and moisturizing properties. Paper soap sheets were prepared by incorporating herbal extracts into a soap base solution followed by casting and drying. Physicochemical evaluation included appearance, pH (6.9), foamability (14-15 ml), thickness (0.20-0.22 mm), washability, and dissolution time (18-20 seconds). Stability studies showed no significant changes in color, odor, and texture during storage. The formulated polyherbal paper soap demonstrated satisfactory cleansing properties, skin-friendly pH, and excellent stability, making it a promising alternative to conventional soaps for personal hygiene, travel, and public health applications.

KEYWORDS: Polyherbal soap; Paper soap; Neem; Tulsi; Turmeric; Eco-friendly; Personal hygiene.

INTRODUCTION

Hand washing with soap is considered one of the most effective methods to reduce microbial transmission and maintain cleanliness.[1] According to the World Health Organization, proper hand hygiene significantly decreases the occurrence of bacterial and viral infections, especially respiratory and gastrointestinal diseases. Paper soap has emerged as a modern and convenient hygiene product due to its compact size, ease of use, biodegradability, and single-use hygienic design.[2] Unlike conventional soap bars and liquid soaps, paper soap is lightweight, easy to carry, and suitable for travel, hospitals, schools, and public places, reducing soap wastage and contamination risk. Conventional soaps often contain synthetic chemicals and harsh surfactants which may cause skin irritation and environmental pollution.[3] Therefore, there is growing interest in herbal and natural cosmetic products due to their safety, therapeutic value, and minimal side effects. Polyherbal formulations combining different medicinal plants provide synergistic therapeutic activity. This study focuses on formulating polyherbal paper soap using selected medicinal plants with established antimicrobial and skin-protective properties.[4,5]

MATERIALS AND METHODS

Materials

All herbal ingredients (Tulsi leaves, Neem leaves, Turmeric) were procured from authenticated suppliers. Fresh Aloe vera leaves were collected from medicinal plants. Glycerin, soap base, and perfume were obtained from pharmaceutical suppliers. Analytical grade chemicals and distilled water were used throughout the study.

Table 1: Ingredients and their activities in polyherbal paper soap.

S. No.	Ingredient	Activity
1	Tulsi extract	Antiseptic, Antimicrobial
2	Neem extract	Antibacterial, Antifungal
3	Turmeric extract	Antioxidant, Anti-inflammatory
4	Aloe vera gel	Moisturizing, Soothing
5	Glycerin	Humectant, Skin softening

Preparation Methods

Herbal Material Collection and Extraction:

Fresh Tulsi and Neem leaves were collected, washed, shade-dried, and powdered. Turmeric powder was obtained from authenticated suppliers. For extraction, accurately weighed herbal powders were mixed with distilled water in suitable proportions and heated gently with continuous stirring for complete extraction of active constituents. The extracts were cooled and filtered through muslin cloth followed by filter paper. Aloe vera gel was extracted from fresh leaves by removing the outer green covering and collecting the transparent inner gel.

Fig 1: Neem & Turmeric Powder.

Formulation and Casting

The prepared soap base solution was mixed with herbal extracts in the following sequence: Tulsi extract, Neem extract, Turmeric extract, Aloe vera gel, and glycerin. The final mixture was stirred continuously until homogeneous. The formulation was poured onto clean glass plates, spread uniformly to maintain consistent thickness (0.20-0.22 mm), and allowed to dry at room temperature. After complete drying, the films were peeled and cut into uniform square strips.

Fig 2: Extraction Neem Leaves Powder.

Steps used

1. Clean glass plates or butter paper sheets were selected as casting surfaces.
2. The prepared formulation was poured carefully onto the surface.
3. The formulation was spread uniformly using a sterile spreader to obtain thin film.
4. Thickness of the layer was maintained uniformly throughout the surface.
5. The coated sheets were allowed to dry at room temperature.
6. Drying was continued until complete removal of moisture occurred.
7. The dried soap film was peeled carefully from the surface.
8. The film obtained was cut into small square or rectangular strips of uniform size.
9. Prepared paper soap sheets were packed in airtight containers for storage.

RESULTS

Physicochemical Evaluation

The formulated paper soap sheets were thin, flexible, smooth, and free from cracks or irregularities. The color was light greenish-yellow due to herbal ingredients. Organoleptic properties showed pleasant herbal fragrance and uniform distribution of ingredients.

Table 2: Physicochemical evaluation results of polyherbal paper soap.

Parameter	Results	Interpretation
pH	6.8-7.0 (avg 6.9)	Skin-friendly
Foamability	14-15 ml	Adequate
Thickness	0.20-0.22 mm	Uniform
Dissolution time	18-20 seconds	Rapid
Washability	Good	No residue

Stability Study

Stability studies conducted over 60 days at room temperature showed no significant changes in color, odor, texture, or flexibility. The formulation remained stable without any signs of degradation, indicating good shelf-life stability under proper storage conditions.

Fig 3: Stability of product

Foamability Test

The formulation showed good foaming capacity and easy spreadability during hand washing.

Washability evaluation revealed that the prepared paper soap dissolved rapidly in water and was easily washable without leaving sticky residue on the skin. The formulation effectively removed dirt and oil from the skin surface and provided refreshing feeling after washing.

Table 2: Foamability Test result.

Trial	Foam Height
1	14 ml
2	15 ml
3	14 ml

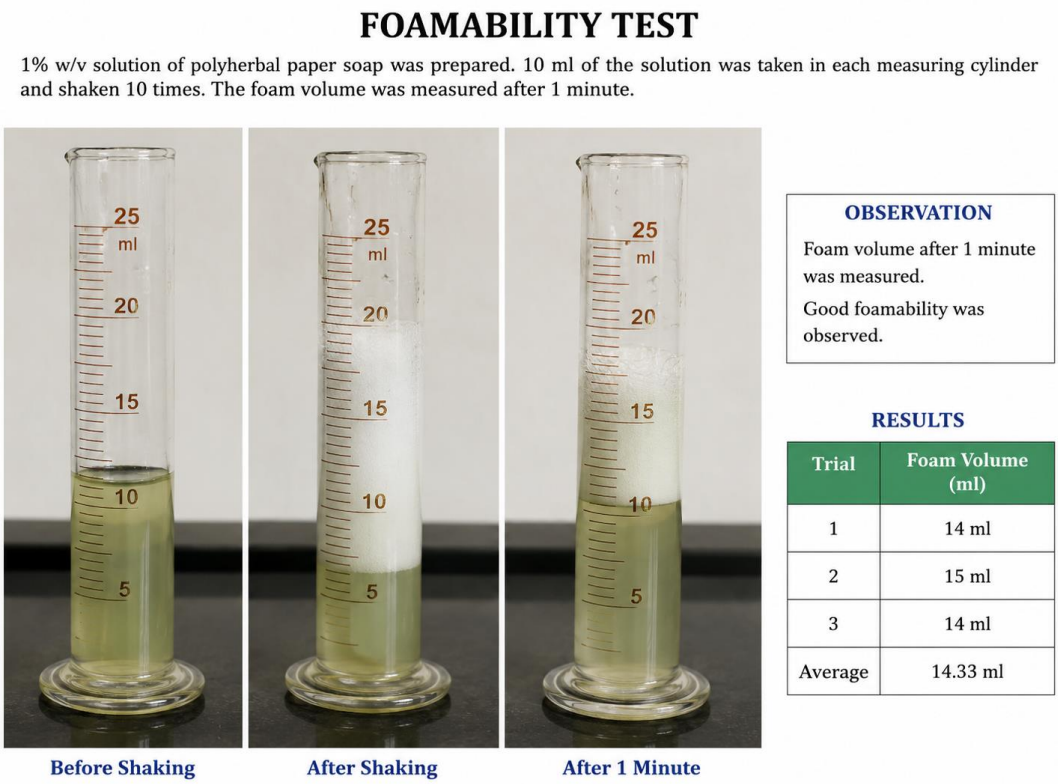

Fig 4: foamability test.

Washability Observation

Thickness evaluation demonstrated that the prepared soap sheets possessed uniform thickness throughout the surface. Uniform thickness is important for proper dissolution and handling characteristics of paper soap.

Table 2: Washability Test result.

Parameter	Observation
Ease of Washing	Good
Cleansing Action	Satisfactory
Residue After Washing	Absent
Skin Feel	Smooth and Refreshing

Fig 4: Washability test.

DISCUSSION

The formulated polyherbal paper soap demonstrates the successful incorporation of traditional medicinal plant extracts into a modern hygiene delivery system. The neutral pH (6.9) ensures compatibility with normal skin pH, reducing the risk of irritation compared to conventional alkaline soaps.[6] The observed pH aligns with WHO recommendations for skin-cleansing agents, making the formulation suitable for daily use and sensitive skin applications. The adequate foamability (14-15 ml) indicates sufficient surfactant activity for effective dirt removal, while the rapid dissolution time (18-20 seconds) ensures convenient hand washing.[7] The uniform thickness and flexibility of paper soap sheets facilitate handling and storage, addressing key consumer demands for portable hygiene products. The incorporation of glycerin (humectant) and Aloe vera gel (moisturizer) provides additional benefits by preventing transepidermal water loss and maintaining skin hydration post-washing, distinguishing this formulation from conventional soaps that may cause dryness.[8] The herbal ingredients contribute multiple therapeutic benefits through their antimicrobial, antioxidant, and anti-inflammatory properties. Neem extract contains azadirachtin, which exhibits broad-spectrum antimicrobial activity.[9] Tulsi extract provides eugenol and other phenolic compounds with antioxidant and antiseptic effects.[10] Turmeric contributes curcumin, known for its anti-inflammatory and antioxidant properties.[11] The stability data demonstrates that the formulation retains its physical and chemical properties under normal storage conditions, indicating commercial viability and sufficient shelf-life for market distribution.[12]

CONCLUSION

The present study successfully developed a polyherbal paper soap formulation combining traditional medicinal plant extracts with modern hygiene delivery technology. The formulation exhibits satisfactory physicochemical properties, including skin-compatible pH, adequate cleansing action, and good dimensional uniformity. The incorporation of natural ingredients provides enhanced antimicrobial, antioxidant, and moisturizing benefits, making it a promising alternative to synthetic soaps. The rapid dissolution, portable format, and single-use design address contemporary hygiene needs in travel, hospitals, schools, and public health settings. Future investigations should focus on in-vitro antimicrobial efficacy testing, dermatological safety evaluation, and large-scale production optimization to enhance commercial applicability and market potential of this eco-friendly cleansing product.

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