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Development and evaluation of natural polyherbal soap

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Abstract

This research focuses on the formulation of polyherbal soaps using natural ingredients such as neem, aloe vera, shikakai, rose water, and Multani mitti. The primary objective was to develop an eco-friendly, skin-beneficial soap with antibacterial, antioxidant, and skin-conditioning properties, as opposed to synthetic soaps containing harsh chemicals. The soap base was formulated using a cold process method, incorporating key ingredients at varying concentrations, such as neem oil (*Azadirachta indica*), aloe vera gel (*Aloe barbadensis*), and others, to enhance the soap's effectiveness in treating skin issues.

The study evaluates the prepared polyherbal soap formulations (F1, F2, F3, F4) based on organoleptic characters, pH, foam height, foam retention, irritation, and antimicrobial activity. The results showed that all formulations exhibited desirable attributes such as a pleasant fragrance, good lather, and no irritation upon skin application. The pH remained stable at 9 across all formulations, and antimicrobial activity was observed, with the F4 formulation demonstrating the highest inhibition zone (14mm) against E. coli.

The findings suggest that polyherbal soaps possess superior therapeutic properties compared to conventional synthetic soaps, offering benefits such as enhanced skin hydration, acne control, and protection against infections. These formulations are considered promising for inclusion in skincare regimens, with minimal chemical content and more holistic benefits. Further clinical studies are recommended to validate these results and explore the broader potential of polyherbal soaps in skincare applications.

Keywords: Polyherbal soap; Neem; Aloe vera; Shikakai; Multani mitti; Antimicrobial; Skincare; Eco-friendly; hydration; Acne control

1. Introduction

In response to these concerns, many people are turning to natural soaps, especially herbal ones. Herbal soaps, made from plant-based ingredients like seeds, nuts, and rhizomes, are free from artificial chemicals and offer additional health benefits such as antibacterial, antioxidant, and antiseptic properties.

Polyherbal soap is a type of herbal soap that combines different plant extracts, each chosen for its therapeutic properties. These soaps are commonly used to treat skin conditions such as eczema, acne, rashes, psoriasis, and dry skin. The process of making polyherbal soap can be done through three methods: melt-and-pour, cold process, and hot process.

Compared to synthetic soaps, herbal soaps have several advantages:

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- They are milder on the skin, making them suitable for sensitive skin.
- They contain natural ingredients like coconut oil, shea butter, and aloe vera, which nourish and hydrate the skin.
- They are free from harsh chemicals, artificial perfumes, and colors, reducing the risk of allergies and irritation.
- They are environmentally friendly and biodegradable.
- They can offer aromatherapy benefits when infused with essential oils.
- Some herbal ingredients, like neem and tea tree oil, have antibacterial properties that help protect the skin.

In this experiment, we prepared a polyherbal soap using neem, aloe vera, shikakai, and multani mitti as the key ingredients. The soap was formulated using the cold process method and evaluated for various parameters such as appearance, pH, foam height, foam retention, and skin irritation. The goal was to assess the antibacterial properties and effectiveness of the soap for treating skin conditions.

- Neem (Azadirachta indica)
    - Other Names: Margosa, Indian Lilac, Nimtree
    - Source: Neem is a fast-growing tree native to India, found in Africa, Southeast Asia, and the Caribbean.
    - Family: Meliaceae
    - **Uses**: Treats skin issues like acne, eczema, and psoriasis. It's also used for wound healing, as an antibacterial, antiseptic, and insecticide
- Aloe Vera
    - Other Names: Aloe Barbadensis, Aloe Vulgaris
    - Source: Aloe Vera is found in regions like the Middle East, North Africa, India, and the United States.
    - Family: Asphodelaceae
    - **Uses**: Used for wound healing, improving digestive health, and as a skincare ingredient due to its moisturizing and anti-aging properties. It soothes skin irritation and inflammation.
- Shikakai (Acacia concinna)
    - Other Names: Saptalaa, Shitalaa
    - Source: Found in regions like Central and Southern India and Southeast Asia.
    - Family: Fabaceae (Legume)
    - **Uses**: Used for hair and skin care. It helps with acne, infections, and dandruff. It's also known for promoting hair growth and maintaining skin health.
- Rose Water (Gulab Jal)
    - Source: Derived from steam-distilled rose petals.
    - Family: Rosaceae
    - **Uses**: Used for skin hydration, reducing redness, and balancing pH. It also has antimicrobial properties and is a natural preservative.
- Multani Mitti (Fuller's Earth)
    - Source: Found in South Asia, used for centuries in Ayurvedic practices.
    - Composition: Contains silica, alumina, and minerals like magnesium and calcium.
    - **Uses**: Helps absorb oil, remove impurities, exfoliate skin, and tighten pores. It's great for controlling acne and promoting healthy skin.

2. Methodology

Formulation of Soap Base (Cold Process Method)

- Preparation of Lye Solution:
    - Take 40g of distilled water in a beaker.
    - Add 10g of caustic soda (NaOH) to the water. This forms the lye solution, which is essential for saponification.
    - Let the solution rest for 30 minutes to allow the caustic soda to dissolve completely in the water. This ensures a proper chemical reaction with oils later.
- Preparation of Oil Mixture:
    - In another beaker, take 70g of coconut oil. Coconut oil helps in making the soap hard and lathers well.
    - Add 30g of stearic acid to the coconut oil. Stearic acid is a fatty acid that acts as a hardener, providing structure to the soap.
- Combining the Lye and Oil Mixtures:
    - Gradually pour the lye solution (prepared in Step 1) into the oil mixture (prepared in Step 2).

  - Stir the combined mixture gently to mix the oil and lye. The chemical reaction, saponification, begins, which will eventually produce soap and glycerin.
  - Heat the mixture for 10 minutes while stirring slowly. Heating helps the reaction take place efficiently and improves the texture of the soap base.
- Adding Other Ingredients:
  - After heating, add 17g of glycerin. Glycerin is a humectant that helps to retain moisture in the soap, preventing it from drying out.
  - Add 70g of alcohol to the mixture, which serves as a preservative to improve shelf life. Stir the mixture well to ensure it is homogeneous.
  - Cover the solution and allow it to rest for 5 minutes. This allows the ingredients to combine thoroughly and stabilize.
- Incorporating Propylene Glycol:
  - After the resting period, add 90g of propylene glycol. This ingredient helps to enhance the moisturizing properties of the soap and smoothens its texture.
  - Stir and heat the mixture for an additional 2 minutes to ensure everything blends well.
  - Blending and Pouring into Molds:
  - After thoroughly mixing, pour the prepared soap base into molds or containers of your choice.
  - Allow the soap to cool and set for 1 day. During this time, the soap hardens, becoming ready for further processing or use.

Preparation of Polyherbal Soap

- Liquefying the Soap Base:
  - Take the required amount of the prepared soap base (from the previous step) in a 500ml beaker.
  - Heat the soap base in a water bath at 45°C. This gentle heat liquefies the soap base, making it easier to incorporate herbal ingredients.
- Adding Herbal Ingredients:
  - Add the specific ingredients for the polyherbal soap formulation. These could include ingredients like neem powder, aloe vera extract, shikakai water, multani mitti, and rose oil, depending on the desired properties.
  - Do not stir the mixture during this process to avoid creating bubbles or disturbing the mixture.
  - Keep the mixture on the water bath at 45°C to ensure thorough mixing without compromising the properties of the herbs.
- Pouring the Soap Mixture into Molds:
  - After the soap mixture is well-blended with the herbal ingredients, carefully pour the mixture into soap molds.
  - Freeze the molds for 2 to 3 hours to allow the soap to solidify completely.
- Removing the Soap from Molds:
  - After freezing, remove the soap from the molds.
  - Allow the soap to rest for about 5 minutes to further settle and harden.

Table 1 List of soap base Ingredients

Ingredient	**Quantity**	**uses**
Disstilled Water	40 ml	Aqueous vehicle
Caustic Soda	10 gm	lye
Coconut oil	70 gm	Moisturizer,Antiageing
Steric acid	30 gm	Hardner
Glycerin	17 gm	Moisturizer
Propylene Glycol	70 gm	Improve moisturizing properties
Alcohol	70 gm	Preservative

Table 2 List of soap formulation

S.NO	Parametrs	F1	F2	F3	F4
1	Colour	Brown	Brown	Brown	Dark Brown
2	odour	Aromatic	Aromatic	Aromatic	Aromatic
3	shape	quadrangular	quadrangular	quadrangular	quadrangular
4	PH	9	9	9	9
5	Foam height	10 cm	12 cm	15 cm	19 cm
6	Foam retention	5 min 10 sec	6 min 20 sec	8min	9 min 30 sec
7	Irritation	No irritation	No irritation	No irritation	No irritation
8	Antimicrobial activity	9mm	11mm	12mm	14mm

Evaluation Parameters of Polyherbal Soap

- Organoleptic Characteristics:
  - Color: The color of the soap is checked visually using the naked eye to ensure consistency and the desired shade.
  - Odor: The fragrance of the soap is evaluated by applying a small amount to the hands and assessing the scent.
  - Shape: The shape of the soap is evaluated, ensuring it has a quadrangular or desired shape.
  - Appearance: The soap should have a smooth, uniform texture and should not have any visible cracks or imperfections.
- pH Testing:
  - The pH of the soap is measured by dissolving 1g of soap in 10 ml of water.
  - Use pH paper to test the solution. A pH value between 9 and 10 is ideal for soap, ensuring it is neither too harsh nor too mild for the skin.
- Foam Height:
  - Take 1g of soap and dissolve it in 10 ml of distilled water in a measuring cylinder.
  - Shake the mixture 25 times and allow it to stand.
  - Measure the height of the foam formed above the water, indicating how well the soap produces foam.
- Foam Retention:
  - Take 25 ml of a 1% soap solution and place it in a 100 ml measuring cylinder.
  - Cover the cylinder and shake it 10 times.
  - Measure the foam volume at 1-minute intervals for 5 minutes. The rate at which the foam dissipates will indicate the soap's quality.
- Irritation Test:
  - Apply the soap to the skin for 10 minutes and observe any signs of irritation or discomfort.
  - If there is no irritation, the soap can be considered safe for use.
- Patch Test:
  - Perform a patch test by applying a small amount of soap to a discreet area of the skin.
  - Observe for 2-3 days for any signs of allergic reactions, such as redness, itching, or swelling.
- Antimicrobial Test:
  - Prepare a soap solution by dissolving 1g of soap in 5 ml of sterile water.
  - Use the agar well diffusion method for testing antimicrobial activity.
  - Inoculate Sabouraud's dextrose agar plates with *E. coli* and place the soap solution in wells on the plate.
  - Incubate the plates at 30 °C for 5-7 days.
  - Measure the diameter of the zone of inhibition around the wells to determine the antimicrobial effectiveness of the soap

Figure 1 Polyherbal soap

3. Results

Table 3 Results

S.NO	PARAMETRS	F1	F2	F3	F4
1	Colour	Brown	Brown	Brown	Dark Brown
2	odour	Aromatic	Aromatic	Aromatic	Aromatic
3	shape	quadrangular	quadrangular	quadrangular	quadrangular
4	PH	9	9	9	9
5	Foam height	10 cm	12 cm	15 cm	19 cm
6	Foam retention	5 min 10 sec	6 min 20 sec	8min	9 min 30 sec
7	irritation	No irritation	No irritation	No irritation	No irritation
8	Antimicrobial activity	9mm	11mm	12mm	14mm

Figure 2 Ph of Herbal soap

Figure 3 Foaming index

4. Conclusion

The formulated polyherbal soap, prepared using the cold process technique, exhibited strong antioxidant and antibacterial properties, making it a natural alternative to synthetic soaps. Among the tested formulations, F4 demonstrated the highest efficacy. Standardization parameters, including organoleptic and physiological assessments, confirmed its quality and safety. While the results are promising, further clinical studies are needed to validate its long-term effectiveness.

Compliance with ethical standards

Disclosure of conflict of interest

No Conflict of Interest, To be disclosed

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