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A Natural Cleanse: Reviewing the Antibacterial and Dermal Benefits of a Bougainvillea-Based Herbal Soap

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Abstract: The present study was designed to explore the anti-bacterial activity of different extracts of the flowers of the bougainvillea glabra using water as the solvent . Various physicochemical tests are being done to observe the anti-bacterial activity of the prepared extract. Additives are used such as aloevera which helps to promote the smoothing of the skin. The shikakiis used to observe the foaming effect which helps to clean the surface. The gelatin soap base is used to moisturizing effect on the skin. The rosemary essential oil is used for flavouring, and which helps in the skin toning.

Keywords: Bougainvillea, herbal soap, anti-bacterial activity.

1. Introduction

In recent years, there has been a growing interest in the use of natural, plant-based ingredients for the formulation of personal care products. Consumers are increasingly inclined towards herbal alternatives due to their perceived safety, biocompatibility, and environmental sustainability. Bougainvillea glabra, a widely known ornamental plant, has attracted scientific attention for its medicinal properties, including antimicrobial, antioxidant, and anti-inflammatory effects. The integration of Bougainvillea extracts into skincare products such as soaps presents a promising avenue for harnessing these benefits in daily hygiene practices.

This study explores the formulation and evaluation of an herbal soap incorporating Bougainvillea glabra flower extracts along with complementary natural ingredients like aloe vera, shikakai, and rosemary oil. The objective is to assess the soap's antibacterial efficacy, dermal safety, and physicochemical properties. By conducting a series of tests including pH analysis, microbial inhibition, foaming ability, and skin irritation studies, this research aims to validate the potential of Bougainvillea-based soap as a natural alternative to synthetic antibacterial cleansers.

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2. Method of Preparation

Step-1: Melt the Glycerine Soap Base

- Cut the block of Glycerine soap into cubes
- The smaller pieces will melt at the 28^{o}c to37^{o}c

Double Boiler Method

1. **Prepare your double boiler:** Set up a pot with small amount of water on the stove and place a heat proof bowl on the top to create a double boiler..
2. **Melt the base:** Add the soap pieces to the top pot of the double boiler and heat on low to medium heat, stirring regularly until completely melted.
3. **Add herbs and essential oils:** Once the soap base melted removed from heat and stir in your chosen dried herbs and essential oils.

Pour into mould: Carefully pour the soap mixture into your prepared mould.

Step-2: Adding the Herbs

Table No: 1 Adding of Herbs

S. No	Herbs	Quantity
1.	Bouganvillea powder Extract	20grams
2.	Shikkaki	2grams
3.	Aloe vera	10grams
4.	Rosemary oil	Required quantity
5.	Glycerine soap base	Required quantity

3. Extraction of Shikakai

Shikakai extracted by using solvent extraction method.

Microwave extraction: Cut and dried shikakai fruits placed in water to extract the shikakai.

Solvent extraction: The shikakai plant fruit, bark, leaf and pods are extracted using a solvent.

Extraction of Aloevera

Harvest: Wash the aloevera leaves and remove the outer skin and spiny parts.

Remove The Outer Skin: Use a vegetable peeler to remove the thick outer skin.

Extract Gel: Use a spoon to separate the leaf from the gel.

Filter: Filter the extract remove the phenolic compounds.

Step-3: Adding Them to the Soap Moulds

- Take the neat and clean mould and add the mixture to mould and add the mixture to mould and cool down.
- Leave them for 1hour to cool.

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Figure No:1 Extraction of aloe vera

Figure No: 2 adding of the herb

Figure No: 3 Soap base

Figure No: 4 Extraction of shikakai

4. Preparation of E-Coli Bacteria

- Auto calving of glassware like Conical flask, Test tube, Petri dish.
- Take 2.8 grams of nutrient agar medium into a stain less steel dish.
- Now take100ml of distilled water and make it into slurry.
- Place the stainless steel dish on the Bunsen burner. Heat it up to one hour.
- Now place it in the laminar air flow unit, under sterile conditions transfer the prepared nutrient broth into conical flask.
- Now the conical flask should be plugged with the help of cotton in a sterile condition.
- Now use the aluminium foil wrap the conical flask under121,15 LMB,15 mints of time. Cool the mixture. The cooled mixture is placed in the laminar air flow unit.
- Take a few amounts of nutrient medium in a sterile test tube and plug with the help of cotton.
- Now take a curd sample, a loop full of micro-organism up to 3 days place it in an incubator. Now the required e-coli is prepared.

5. Microscopic Method

In this we use hanging drop method. The hanging drop method is a technique used in microbiology , cell culture. It involves placing it in a drop of fluid on the coverslip over a concavity in a glass slide. This allows the fluid to hang in a drop which can be observed under a microscope .Clean cover glass and a hallow-ground slide stop. Apply petroleum jelly around them of the slides wall. Place a drop of fluid containing the micro-organism on the cover glass. Invert the glass slide so that the drop hangs from the underside of the cover slip. Place the slide on the microscope.

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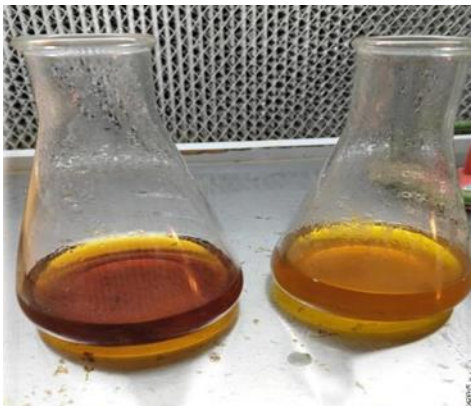


Figure No: 5 Preparation of the nutrient broth

6. Evaluation Parameters

P^H TESTING PROCEDURE:

1. Weigh1gram of the grated soap sample into a clean container.
2. Add 10 ml of distilled water to the soap sample.
3. Stir the mixture until the soap is fully dissolved.
4. Allow the mixture to cool to room temperature (if necessary).
5. Dip the p^H meter probe in to the soap solution, making sure not to touch the probe to the container.
6. Stir the solution gently and wait for the p^H reading to stabilize.
7. Record the p^H reading.

Observation: The p^H reading was found to be neutral.

Table No: 2 Observation Of P^H Value

S.NO	INGREDIENTS	QUANTITY REQUIRED	OBTAINED VALUE
1	Soap sample	2 grams	Neutral
2	Distilled water	10ml	

Moisture Content Procedure

1. Sample Preparation: Prepare a soap sample (e.g.,10g) and record its initial weight.
2. Drying: Dry the soap sample using one of the methods above (e.g., oven drying).
3. Weight Measurement: Measure the weight of the dried soap sample.
4. Calculation: Calculate the moisture content using the formula:
5. Moisture Content (%)=((Initial Weight-Final Weight)/Initial Weight)x 100.

Table No:3 Observation of Moisture Content

Sample	Initial Weight	Final Weight
Soap sample	10grams	8grams

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1. Fill the foaming ability tester with 1000 ml of distilled water at a temperature of 25°C ± 2°C.
2. Weigh 1gram of the herbal soap sample and carefully place it into the tester's sample holder. Allow the soap to dissolve and foam for 5 minutes.
3. Measure the initial foam height (in millimeters) using a ruler or caliper.
4. Record the initial foam height. Allow the foam to settle for 5 minutes
5. Calculate the foam stability as follows:
6. $Foam\ Stability(\%) = (Final\ Foam\ Height/Initial\ Foam\ Height) \times 100$

Table No:4 Foaming Ability

Ingredients	Weight Of Sample	Initial Height	Final Height
Soap sample	1gram	Above100	90
Distilled water	100ml		

Microbial Test Procedure

1. Sample Preparation: Prepare a soap sample by cutting or grinding it into a uniform size.
2. Media Preparation: Prepare microbial growth media, such as agar plates or broth, according to the testing requirements.
3. Inoculation: Inoculate the soap sample onto the prepared media using a sterile technique .
4. Incubation: Incubate the inoculated media at a controlled temperature(e.g.,37°C)for a specified period (e.g., 24-48 hours).
5. Observation and Enumeration: Observe the growth of microorganisms on the media and enumerate the colonies using a colony counter or manual counting
6. Identification: Identify the isolated microorganisms using various techniques, such as Gram staining, biochemical tests, or molecular methods.
7. Data Analysis: Analyze the data to determine the microbial load and identify any potential contaminants.

Total Fatty Matter Procedure

1. Sample Preparation: Prepare a herbal soap sample by grinding or crushing it into a fine powder.
2. Extraction: Extract the fatty matter from the soap sample using a solvent, such as ether or petroleum ether.
3. Drying: Dry the extracted fatty matter to remove any residual solvent.
4. Weighing: Weigh the dried fatty matter to determine its weight.
5. Calculation: Calculate the TFM percentage using the following formula:
6. $TFM(\%) = (Weight\ of\ fatty\ matter/\ Weight\ of\ soap\ sample)x100 = (3.75/5)X100 = 75$

7. Skin Irritation

- Screening: Select volunteers with no skin allergies or sensitivities.
- Patch application: Apply the herbal soap solution (0.2mL) to a patch and place it on the volunteer's forearm.
- Control patch: Apply a distilled water patch as a control.
- Adhesive tape: Secure the patches with adhesive tape.
- Exposure period: Leave the patches on for 48 hours.
- Removal and evaluation: Remove the patches and evaluate the skin reactions after 1 hour, 24 hours, and 48 hours.

Observation

While using the prepared soap there was no irritation.

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8. Foam Retention

1. Prepare the soap solution: Weigh 10-20 grams of herbal soap and dissolve it in 200-400 mL of distilled water at a temperature of 25°C± 2°C.
2. Create foam: Use a mechanical whisker to create a rich, creamy foam on the surface of the soap solution.
3. Measure initial foam height: Measure the initial height of the foam using a ruler or caliper.
4. Record foam height over time: Record the foam height at regular intervals (e.g., 1, 2, 5, and 10 minutes) using a stop watch or timer.
5. Calculate foam retention: Calculate the foam retention using the following formula:

$$Foam\ Retention(\%) = (Foam\ Height\ at\ Time\ t/Initial\ Foam\ Height)x100$$

Observation

$$Foam\ retention\ (\%) = (20/100)\ x\ 100\ =\ 20$$

9. Anti-Bacterial and Antioxidant Test

1. Test Microorganisms: Select relevant bacteria, such as Staphylo coccus aureus, Escherichia coli, or Pseudomonas aeruginosa.
2. Soap Sample Preparation: Prepare a 1%solution of the herbal soap in distilled water.
3. Inoculum Preparation: Prepare a bacterial inoculum by suspending the microorganism test in a nutrient broth.
4. Agar Plate Preparation: Prepare agar plates with a suitable growth medium.
5. Test Procedure: Apply the soap solution to the agar plates using a sterile swab. Inoculate the plate with the bacterial inoculum. Incubate the plate at 37°C for 24 hours.
6. Zone of Inhibition: Measure the zone of inhibition (in mm) around the soap-treated area.

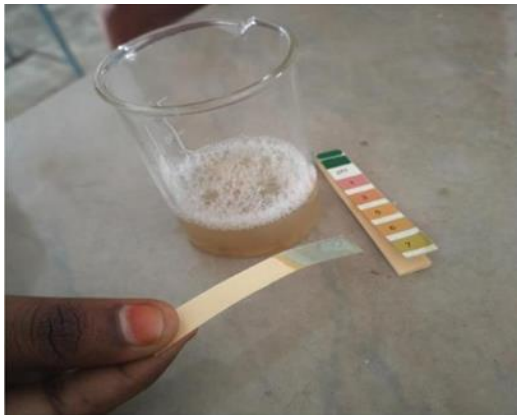

Figure No: 6 PH testing

Figure No:7 Skin irritation

Figure No: 8 Anti-Bacterial growth

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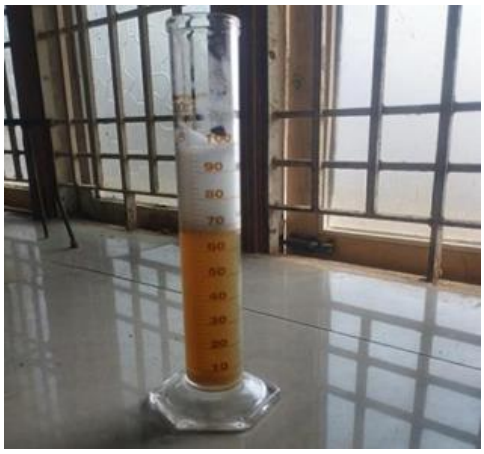

Figure No: 9 Foam Retention

Figure No: 10 Total fatty matter

Figure No: 11 foam ability

Figure No: 12 Microbial tests

Figure No: 13 Soap Moulds

Figure No: 14 Prepared Herbal Soap

10. Conclusion

The present study successfully demonstrated the potential of Bougainvillea glabra flower extract as a key ingredient in the formulation of an effective herbal soap. The inclusion of natural additives such as aloe vera, shikakai, and rosemary oil not only enhanced the cleansing and moisturizing properties of the soap but also

contributed to its overall antibacterial and dermal benefits. The prepared soap exhibited satisfactory physicochemical characteristics, including neutral pH, good foaming ability, and stable foam retention. Microbial tests confirmed significant antibacterial activity against common pathogens like *Escherichia coli*, indicating its effectiveness in promoting hygienic skin care. Additionally, the skin irritation test confirmed its dermal safety for general use.

Overall, the study supports the use of Bougainvillea-based herbal soap as a natural, skin-friendly, and eco-conscious alternative to commercially available antibacterial soaps. Future work may explore variations in extract concentrations, long-term skin benefits, and broader antimicrobial testing to further validate its commercial potential.

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