



Formulation And Evaluation Of Antibacterial Paper Soap From “*Eucalyptus Oil*”

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Abstract:

Skin infections related to bacteria are most commonly found in surrounding environment. In such cases the significant attention to provide curative actions and maintenance of proper health hygiene is required. Some of the natural extracts obtained from herbal plants possess antibacterial activity. The paper soap is most used handwash preparation in this article formulate antibacterial paper soap with eucalyptus oil and evaluate their parameter and in-vivo antibacterial activity. However, aroma therapy is pleasant, eco-friendly and reduced number of side effects. The study indicates that the evaluated paper soap contain may be antimicrobial properties and this can contribute the curative and preventive actions for skin infections caused by bacteria if well balanced quantity of natural excipient and reagents to target particular contribute organisms and packaged with proper guidance for utilization and storage.

The present study focuses on the formulation and evaluation of paper soap enriched with natural extracts to provide effective cleansing while offering medicinal and skincare benefits. Extracts such as, Eucalyptus leaves and other ingredients were incorporated into the soap formulation to enhance its antibacterial, antifungal, and moisturizing properties. The soap was prepared by impregnating the formulation onto a biodegradable paper base to create a portable and eco-friendly alternative to conventional soaps.

Key word: Soap paper, Anti bacterial, Eucalyptus oil.

1.INTRODUCTION:

Health hygiene is very essential due to increasing number of diseases caused by microorganisms. Since ancient time, soap is a fundamental part of human health hygiene. In the modern era bath soap that is available in the market are mainly of two types: solid soap and liquid soap. Selection of soap by people depends on various factors one of which is ease of carrying. Paper soap itself is an innovation to the soap formulation which is printed and moulded as slender as paper. To keep us the essential cleanliness while traveling, it is very imperative to have soaps handy. This is the place where travel soaps populated as paper soaps become an integral factor. When comes in contact with water it easily gets wet and produce foam similar to ordinary soap and gels. Paper soap is produced on big industrial scale majorly in China. The paper soap is made from variety of materials, such as methyl paraben, propyl paraben, glycerine, carbomer. Until now there are very a

smaller number of paper soap preparations available from natural ingredients/agents such as eucalyptus oil, neem oil, coconut oil which are safe and healthy for topical use.

To experience the refreshing and soothing power of eucalyptus in a whole new way - with our eucalyptus-infused paper soap! This innovative product combines the natural antiseptic properties of eucalyptus oil with the convenience and eco-friendliness of paper soap. Perfect for on-the-go use, travel, or as a thoughtful gift, our eucalyptus paper soap is a unique blend of nature and innovation. Let's dive into its amazing benefits and uses!

- Hand sanitizer
- Skin soothing
- Insect repellent
- Travel-friendly

Paper soap :

The main focus of our research is manufacture of the paper soap sheet. Paper soap is a thin soap sheet. It is an anionic surfactant that is used in conjunction with water for washing and cleaning. The soap includes a substrate, a cleaning composition, and a holder. The cleaning composition is impregnated in the substrate so as to form a dry cleanser impregnated substrate is laid on to hold on to prevent exposure and evaporation of cleansing composition, since the cleanser impregnated substrate is dry. The holder removable holds at least one stacked dry and cleanser impregnated substrate is dry and cleanser impregnated substrate is removed from a holder and subjected to water, substrate dissolves leaving the cleansing composition dissolve in water for cleansing. It is portable, cheap and easy to use. The paper use in paper soap is environmentally friendly. By dissolving paper in water even if the paper is thrown away, the paper is biodegradable a disposable one. Hand washing with soaps is important because it is proven to clean hands from germs and bacteria. The paper soaps were made from and glycerine as a plasticizer. The aims of this research were to determine both formulation of paper soap using coconut oil and castor oil and based with addition of glycerine, and determine the quality of the paper soaps which is disposable hand soap. Soap shell lets you wash your hand by effectively eliminating 99.9% bacteria by just adding water just before wash. Each travel pack comes with 10-20 thin sheets with each sheet with one hand washing session simple a convenient. This research used laboratory experimental method using descriptive analysis. These biodegradable sheets are advantageous to utilize. The paper soap is little and simple to carry, few paper soap tablets can wash their hands, disinfecting, cleaning is a decent accomplice for healthy self. Paper soaps are surprisingly ideal for travellers. Intended to suit your travel needs, these soaps are very compelling and convenient. For brisk hand wash at any spot whenever carry these global mart paper soaps for a sterile journey. These paper soaps come in adorable packs and shape sand are stuffed in travel friendly, simple to carry tubes. Light and dainty soaps in the warm water. The paper soap is very easy to use, the addition of moisture to avoid dry hands, its scent and it also helps the sink area tidy and makes its more demandable for urban areas especially for children, but in rural areas they don't mostly prefer these products.



Fig no.01

2.LITERATURE REVIEW:-

(Dabhoya Sainbanu, Dalal Kinja...April 2023)

The study eucalyptus indicates that the evaluated paper soap contain may be antimicrobial properties and this can contribute the curative and preventive actions for skin infections caused by bacteria if well balanced.

(Panikar *et al.*, 2021).

Due to its therapeutic potential, Eucalyptus essential oil has found its application in the treatment of various ailments such as bronchitis chronic obstructive pulmonary disease.

(Galan *et al.*,2020)

The use of extracts from Eucalyptus species leaves for the treatment of various ailments especially respiratory problems have a rich folkloric history, especially by the Australian Aborigines.

(Shaffique *et al.*, 2018).

Traditionally, eucalyptus has been utilized in folk medicine for various ailments, including respiratory issues and digestive problems.

(Vecchio *et al.*, 2016)

Eucalyptus species, particularly *E. globulus*, are extensively used in the pulp and paper industry, providing a significant source of raw material for paper production...

(Vecchio *et al.*, 2016)

Medicinal Properties Eucalyptus leaves are rich in essential oils, particularly 1,8-cineole (eucalyptol), which exhibit antimicrobial and anti-inflammatory properties...

(Hiwale, 2015)

The biomass yield of eucalyptus can reach up to 195 quintals per hectare in ten-year-old plantations, making it a valuable crop for construction and other industries...

(Bachhe, 2015)

Oil in the Leaf of *E. globules* has Maximum antibacterial activity against *S. aureus*, while the minimum activity for *P. aeruginosa*.

(Asian Pac J Trop Biomed. 2012 Sep)

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3.AIM AND OBJECTIVE

Aim:-

Formulation and Evaluation of Antibacterial Paper soap From “*Eucalyptus oil*”

Objectives:-

1. To formulate antibacterial paper soap: This involves creating a paper soap product with antibacterial properties.
2. To incorporate eucalyptus oil: The main goal is to include eucalyptus oil in the soap formulation, leveraging its antibacterial qualities.
3. To determine the appropriate concentration of eucalyptus oil: This involves finding the right amount of eucalyptus oil to be effective without causing skin irritation or other issues.
4. To evaluate the physical properties of the paper soap: Assess characteristics like appearance, texture, and ease of use.
5. To evaluate the chemical properties of the paper soap: Test the pH level to ensure it's suitable for skin and check for any adverse chemical reactions.
6. To assess the antibacterial activity: This is a crucial step, testing the soap's effectiveness against common bacteria.
7. To evaluate the stability of the paper soap:
Determine how well the soap maintains its properties over time under different storage conditions.
8. To assess the safety of the paper soap:
Ensure that the ingredients used are safe for skin contact and that the product doesn't cause any allergic reactions or irritation.

4.PLANT PROFILE :



Fig no. 02

- Synonym: Gum tree
- Biological Source: The dried leaves of various Eucalyptus species.
- Family: *Myrtaceae*
- Chemical Constituents: Eucalyptus oil contains cineole (eucalyptol), which is the primary active component, along with other terpenes like alpha-pinene and limonene. The leaves also contain tannins, flavonoids, and phenolic acids.
- Uses:
 - *Medicinal:* Used as an expectorant, decongestant, and antiseptic.
 - It's used to treat respiratory conditions like coughs, colds, and bronchitis.
 - *Aromatherapy:* Eucalyptus oil is used in aromatherapy for its refreshing and stimulating properties.
 - *Industrial:* Used in the production of essential oils, pharmaceuticals, and cleaning products.
 - *other:* Eucalyptus wood is used in construction and paper production.

5.INGREDIENTS

1. Eucalyptus Oil
2. Sodium Lauryl Sulfate (SLS)
3. Glycerin
4. Coconut oil
5. KOH
6. Whatman paper
7. Sodium chloride

EXCIPIENTS

1.POTASSIUM HYDROXIDE (KOH)

In the context of herbal paper soap, potassium hydroxide (KOH) is used as a caustic alkaline agent during the saponification process to transform fats and oils into soap, resulting in a softer, gentler soap compared to soaps made with sodium hydroxide (NaOH). Uses

1. Potassium hydroxide is use to saponify oils & fat
2. Manufacture soaps
3. It can maintain pH balance of soap .

2. CITRIC ACID HOW IT CONTRIBUTES:

Citric acid is commonly used as an excipient in herbal paper soap due to its beneficial properties. Here's

1. pH Regulator and Buffering Agent Citric acid helps maintain the pH of the soap at an optimal level (around 5.5–6.5), which is closer to the natural pH of the skin. This prevents the soap from being too alkaline, reducing the risk of skin irritation and dryness.
2. Enhances Cleansing Efficiency It acts as a chelating agent, binding with metal ions (like calcium and magnesium) found in hard water. By preventing these ions from interfering with the soap, citric acid improves the lathering and cleansing properties of the herbal paper soap.
3. Preservative and Antioxidant Citric acid has mild preservative properties that help extend extend the shelf life of the soap. It inhibits the growth of bacteria, mold, and fungi, preventing the soap from spoiling.

Uses

1. pH adjuster
2. water softener
3. chelating agent

3. GLYCERINE

Uses Glycerine is a key ingredient in herbal paper soap due to its various beneficial properties:

1. Moisturizing: Glycerine is a humectant, meaning it draws moisture from the air into the skin. This helps keep the skin hydrated and soft, preventing dryness, which is especially important in soap.
2. Skin Soothing: Glycerine has a gentle, non-irritating nature, making it ideal for sensitive skin. It helps calm and smooth the skin, reducing irritation or inflammation.
3. Improves Lather: Glycerine can enhance the soap's lathering properties, making it more luxurious and effective when used.
4. Preservation: Glycerine can act as a natural preservative, helping to maintain the soap's shelf life by preventing it from drying out and hardening too quickly.

1. Moisturizer 2. Plasticizer 3. Help to maintain the viscosity of the soap solution

4. CASTOR OIL

Castor oil is a popular ingredient in herbal paper soap for several key reasons:

1. **Moisturizing:** Castor oil is rich in ricinoleic acid, which helps retain moisture in the skin. It provides deep hydration, making the soap especially beneficial for dry or sensitive skin.
2. **Lathering:** Castor oil is known for its ability to create a rich, creamy lather. This improves the overall texture and feel of the soap, making it more enjoyable to use.
3. **Skin Nourishment:** The fatty acids in castor oil help nourish and soothe the skin. It can promote skin softness and may have anti-inflammatory properties that help calm irritated or inflamed skin.
4. **Cleansing:** Castor oil has natural cleansing properties, which help remove dirt and impurities from the skin, leaving it clean and refreshed.

5. ENHANCES SOAP CONSISTENCY: Castor oil contributes to a smoother, more consistent texture in soap, making it easier to apply and more effective during use.

Uses:

1. Moisturizing
2. Softening
3. Contributes to lathering

6. SODIUM CHLORIDE (NaCl)

Sodium chloride (NaCl), or common table salt, is used in herbal paper soap for several important reasons:

1. **Thickening Agent:** NaCl can help adjust the consistency of the soap. In liquid soaps, adding salt helps thicken the mixture, making the soap more stable and easier to use.
2. **Enhancing Lather:** Salt can improve the lathering ability of soap, creating richer and more stable foam when the soap comes into contact with water.
3. **Preservative:** While not as powerful as other preservatives, salt can act as a mild preservative by reducing the water activity in soap, which can help extend its shelf life and prevent microbial growth.
4. **Improves Texture:** In some cases, salt can contribute to a smoother texture in the soap, preventing it from being too runny or uneven.
5. **Balancing pH:** Salt can help balance the pH of the soap, ensuring it is not too harsh or alkaline, making it gentler on the skin.

Uses

1. Help in soap precipitation
2. Enhances lather stability
3. Improve texture

7. SORBITOL

Sorbitol is a key ingredient in herbal paper soap for several important reasons:

1. **Moisturizing:** Sorbitol is a humectant, meaning it attracts moisture from the air and helps retain it in the skin. This helps keep the skin hydrated and prevents dryness, especially when used in soap.
2. **Improves Texture:** Sorbitol contributes to the smooth, soft texture of the soap. It can help make the soap feel more pleasant and smooth when applied to the skin.
3. **Lathering Agent:** Sorbitol can enhance the soap's lather, contributing to a rich, creamy foam when mixed with water, improving the overall user experience.
4. **Prevents Hardening:** In herbal paper soap, sorbitol helps prevent the soap from becoming too hard or brittle, allowing it to maintain its soft, paper-like texture.
5. **Skin Soothing:** Sorbitol is gentle on the skin and can help soothe irritation or dryness, making it especially beneficial for sensitive skin types.

Uses :

1. Increase Thickness
2. Humectant to prevent moisture loss

8. SODIUM LAURYL SULFATE (SLS)

Sodium Lauryl Sulfate (SLS) is a surfactant and detergent that can be found in some herbal paper soaps for the following reasons:

1. **Lathering Agent:** SLS is known for its ability to produce a rich and bubbly lather, enhancing the soap's foaming properties when used with water. This makes the soap feel more effective and luxurious.
2. **Cleansing:** As a surfactant, SLS helps remove oils, dirt, and impurities from the skin. It effectively binds with the oils and allows them to be rinsed away, leaving the skin clean.
3. **Emulsifying:** SLS helps mix oil and water-based ingredients in the soap, ensuring a uniform, smooth consistency without separation.

Uses

1. Foaming agent
2. Surfactant
3. Helping to create lather
4. Improve the cleaning power of the soap.

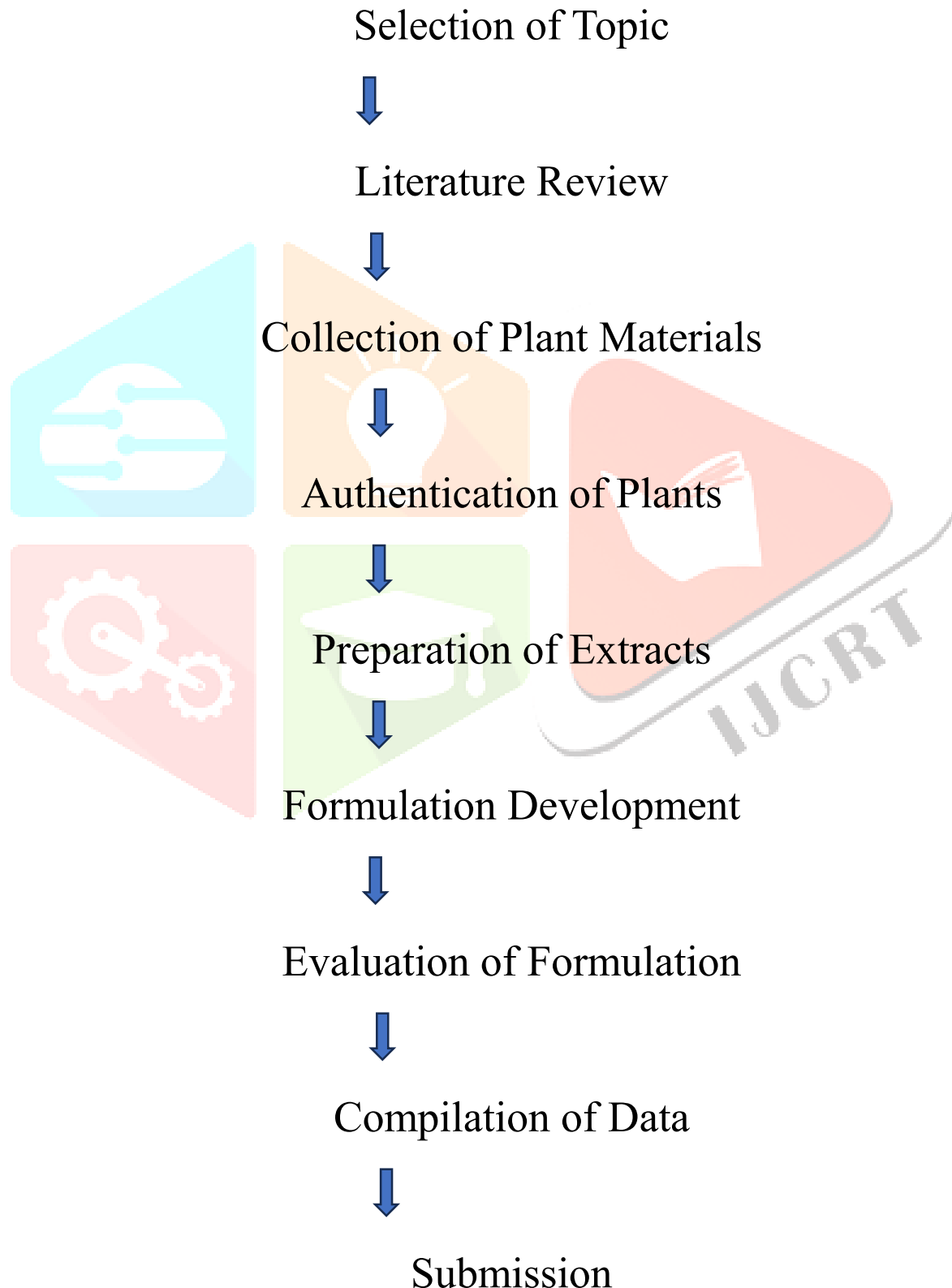
9. WHATMAN PAPER FOR SOAP STRIPS:

The soap solution is then applied to Whatman filter paper, which is then dried to form the paper soap strips.

Advantages of Using Whatman Paper:

1. Whatman filter paper is chosen for its ability to effectively filter out impurities, ensuring a clean and homogeneous product.
2. It also provides a suitable substrate for the soap solution to adhere to, forming the paper soap strips.

6.PLAN OF WORK:



7.Pre Formulation

Organoleptic properties of oil:

Color : Pale Yellowish liquid

Oduor: Strong Fresh ,Woody , Camphoraceous

Taste: Pungent ,Spicy

Solubility : Insoluble in water

Main Constituent : 1,8-

cineol



Fig no.03

Density of Liquid (Oil)

Empty bottle wt.: 16.72

Wt. With eucalyptus oil: 42.46

$$\begin{aligned} \text{Density} &= \frac{\text{Mass}}{\text{volume}} \\ &= 42.46 - 16.72 / 25 \\ &= 1.0296 \text{ gm/ml} \end{aligned}$$

Density of eucalyptus oil is 1.0296 gm/ml

Viscosity of liquid (oil)

Phase 1- 1.17 min

Phase 2- 1.18 min

Phase 3- 1.18 min

Time required for eucalyptus oil = $T_1+T_2+T_3/3$

$$=77+78+78/3$$

$$=77.6$$

Viscosity of oil = 0.92 cp



Fig no.04

8.MATERIALS AND METHOD FOR LIQUID SOAP PREPARATION MATERIALS REQUIRED

1. We require hand gloves form protecting our hand from harmful chemicals
2. Nose mask is required because the chemicals used such as lye is irritant to nose.
3. Turning stick a long spatula is required for adding and stirring purpose of chemicals mixing.
4. Measuring soon a funnel is required for filtration purposes.
5. Plastic bowls glassware's i.e., measuring cylinder, beaker, conical flask etc.
6. Towel for cleaning purpose.
7. Distilled water plenty amount.

8. Thermostat and water bath for heating a saponification process.

9. Bunsen burner for boiled.

FORMULATION TABLE

Sr.no.	Ingredients	Amount
1	Glycerine	10 ml
2	Coconut oil	10 ml
3	KoH	15 gm
4	Nacl	10 gm
5	Castor oil	5 ml
6	Eucalyptus oil	10 ml
7	SLS	15 gm

8.1.METHOD FOR PREPARATION OF LIQUID SOAP

1. Prepare glycerin Measure of glycerine into beaker of required size and heat it on 60C, stir glycerine gently a check temperature with thermometer.



Fig no.05

2. Prepare coconut oil and castor oil mixture: Weigh 10 ml of coconut oil in required amount of beaker, heat coconut oil gently to melt the oil, and take 5ml of castor oil and pour to coconut oil and mix the oils by continuous stirring.



Fig no.06

3. Prepare KOH solution

1. The 50 ml of water and 15gm of Potassium Hydroxide solution added to the flask. The mixture stirred by using stirring rod to mix the contents of the flask. Then keep KOH covered.

2. As KOH dust can be effective to nostrils and throat. Avoid breathing the dust or fumes when mixing KOH solution.

4. Mix soap

1. Gently pour KOH / water solution into glycerine. Heat the soap and maintain temperature of 60-70C. The mixture was stirring continuously during the heating process to prevent the mixture from foaming. If the mixture should foam to the point of nearly overflowing, the flask removed from the boiling-water bath until the foaming subsides, then continue heated. The mixture heated for 2-3hours until it undergoes complete saponification.

2. Then add NaCl solution on the mixture with continuous stirring. The NaCl solution was prepared by adding 16gm of NaCl into 200ml of water and stirs it properly until the NaCl salt dissolves properly then the mixture of alkali, fats an oil, glycerine and salt were heated in thermostat until it goes proper saponification.

3. The mixture was removed from the boiling-water bath and the flask cooled in an ice bath for 10-15 minutes.

4. While the flask is cooling assemble the vacuum filtration apparatus, the vacuum flask secured to a ring stand with a utility clamp to prevent the apparatus from toppling over.

5. A piece of filter paper weighted to the nearest 0.001 g and recorded. The filter paper placed inside the Buchner funnel. The filter paper was moisture with water so that it fits flush in the bottom of the funnel, The 150 ml of saturated, NaCl solution added to the flask to salt out the soap once the flask has cooled.

5. Preparation of Sodium Lauryl Sulfate (SLS) 1. Prepare the SLS Solution: Measure 10-15g of SLS powder. Dissolve the SLS in 70-75g of warm distilled water. Stir continuously until fully dissolved. Add 5-10g of glycerin to keep the soap from becoming too dry and brittle.

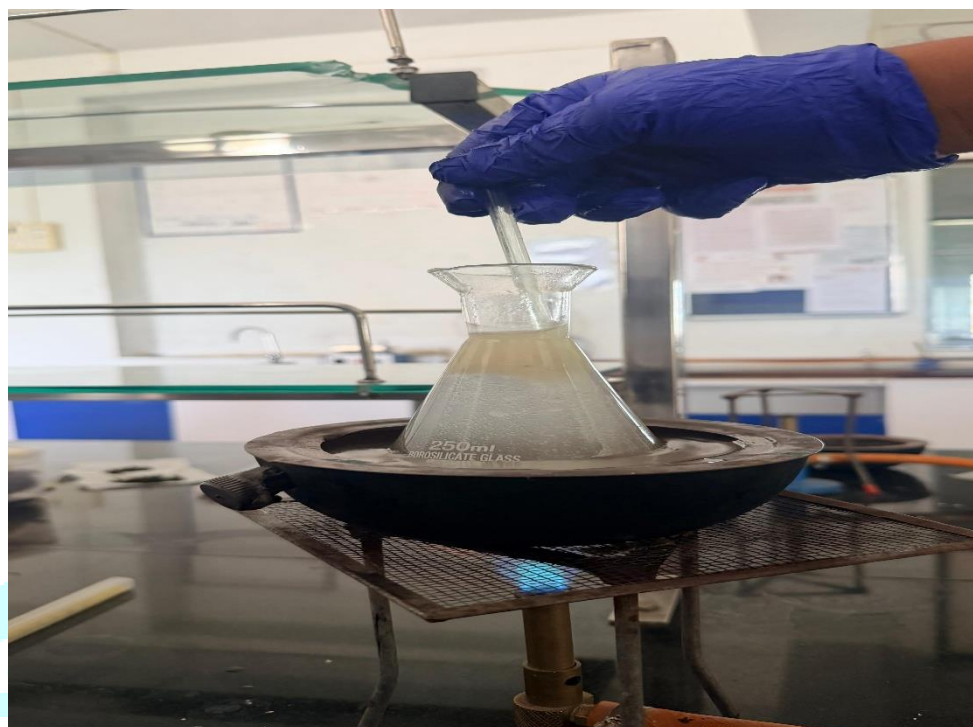
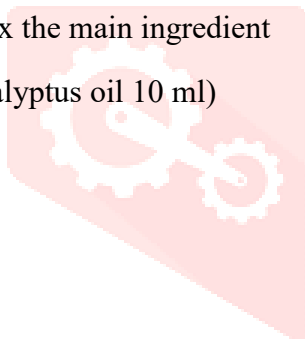


Fig no.07

5. Mix the main ingredient
(Eucalyptus oil 10 ml)



9.EVALUATION TEST

- pH Test

pH of paper soap solution was measured using ph meter. Required pH() was adjusted by 0.1N KOH solution.

- Foam height Test

0.5gm of sample of soap solution was taken, dispersed in 25ml distilled water then, transferred it into 100ml measuring cylinder; volume was make-up to 50ml with water. Then the cylinder was shaken 5 times until the foam is produced. The cylinder was allowed to stand till aqueous volume measured up to 50ml and measured the foam height, above the aqueous volume.

- Sensitivity test

It is done by “patch test”. Apply product on 1cm patch of chicken skin, if no inflammation or rashes then it is considered as free from sensitivity.

- Foam stability

Foam stability is the consistency of the amount of foam produces by paper soap. The resulting foam on paper soap is smoother than the regular soap. The foam is stable in the presence of glycerin & glycerin do not have any significant effect on foam stability.

- Paper spread-ability

A pinch of product should be easily spreadable on paper.

ORGANOLEPTIC EVALUATION

1. Size

Herbal paper soap sheets typically come in sizes around 4.5 x 7 cm (1.77 x 2.6 inches). By using micrometer screw gauge. They are designed for portability and convenience, often sold in packs of 20 or more sheets.

2. Shape

The most common shape for herbal paper soap is circular or round, although some variations might include heart-shaped or other small, portable designs.

3. Oduor

Simple sensory evaluation by smelling the soap and also by evaluating fragrance of rose water.

Herbal and Natural Fragrances: The primary source of the scent comes from the herbs and plant-based ingredients used in the soap.

1. Color -

The yellow color in paper soap can be achieved naturally by using ingredients like eucalyptus oil extract or beetroot powder.

2. Appearance

Good It is design to dissolve easily when in contact with water.

3. pH - 7

The pH scale measures how acidic or alkaline a substance is, ranging from 0 to 14, with 7 being neutral.(pH can be measure by using pH paper)

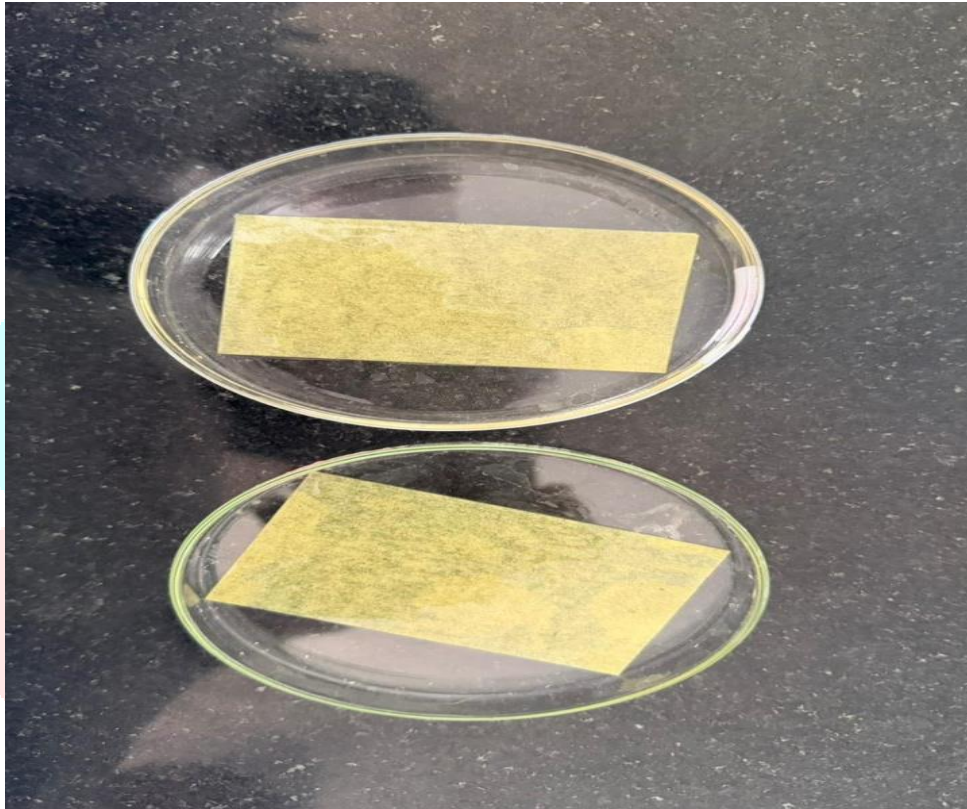


Fig. no.08(2 Sample Batches)

10. RESULT:

Batch-B1	In this batch SLS is used as a foaming agent the foam is not formed & it is insufficient.
Batch-B2	In this batch SLS is used as a foaming agent the foam is not formed & it is insufficient.
Batch-B3	In this batch successful formulation should yield paper soap that is non-irritant, safe & effective for cleansing. stable with adequate disintegration, foaming & convenient for use and storage

CONCLUSION:

The formulation and evaluation of paper soap have demonstrated promising results in terms of safety, effectiveness, and user satisfaction. The incorporation of extracts such as Eucalyptus oil and ingredients has enhanced the antibacterial, antifungal, and moisturizing properties of the paper soap. The formulation showed satisfactory pH, foam stability, and cleansing ability, making it suitable for regular use without causing skin irritation. The evaluation parameters, including physical appearance, weight variation, folding endurance, and microbial efficacy, confirmed the quality and consistency of the paper soap. Overall, the study highlights the potential of herbal paper soap as an eco-friendly and convenient alternative to conventional soaps, providing enhanced skincare benefits while minimizing environmental impact.

AUTHENTICATION:



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F-12, 1962, 26/06/1950
F 1261, 13/10/1961

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SCIENCE COLLEGE, NANDED
(Affiliated to Swami Ramanand Teerth Marathwada University, Nanded)
(Re-accredited with "A+" grade by NAAC (CGPA 3.35) 4th Cycle, CPE Status,
DST-FIST, NIRF Ranking-72 (Year - 2017), Best College Award SRTMUN)
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04/02/2026

Certificate

I have studied the plant material submitted by **Mr. Jagdish Sakhare, Mr. Salokar Sham, Mr. Salunkhe Aditya and Mr. Sawant Ratnakar** students of **B. Pharm** under the guidance of **Ms. P. G. Desai (Project Guide), D. K. Patil Institute of Pharmacy, Loha Dist. Nanded.**

I hereby identify and authenticate that the given Plant material is belonging to

Sr. No.	Botanical Name of Plant	Family
01	<i>Eucalyptus globulus</i> Labill.	Myrtaceae

This certificate is issued as per request and is given only for academic and Research use.



Dr. Vishal R. Marathe
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