



Tree To Suds: Creating Paper Soap With Nature's Essence

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ABSTRACT

This study investigates environmentally friendly soap alternatives, emphasizing biodegradable ingredients and reduced environmental impact. The development and characterization of innovative paper soap formulations incorporating some natural additives were investigated. Regular skin cleansing is essential to maintain hygiene and to prevent allergic reactions amidst constant environmental exposure. This study develops and assesses an innovative paper soap integrating oregano, sandalwood, and olive oils. The soap demonstrated excellent foaming, spreadability, and moisturizing properties. Results showed significant antibacterial activity and skin-nourishing benefits. Evaluating visual appearance and washability, we found that formulations F1, F3, F4, and F5 underwent colour changes and lost effectiveness at certain temperatures. Conversely, F2 demonstrated consistent performance, making it the optimal paper soap formulation. Its eco-friendly, portable design addresses hygiene and skincare needs, making it ideal for outdoor activities and travel. Evaluation tests confirmed the soap's effectiveness, making it a promising solution for sustainable personal care. The findings encourage further development of eco-friendly, efficient personal care products.

Keywords: Paper soap, eco-friendly, oregano oil, sandalwood oil, olive oil.

INTRODUCTION

Cleanliness is crucial due to the rising incidence of bacterial and germ-related diseases. Cosmetics are beauty and health products designed for facial and body care or to enhance and modify one's appearance. Beyond improving looks, they are also used for skincare, body care, and fragrance. Although cosmetics are largely linked with skin and body care, they serve multiple purposes. The main purpose of cosmetics is to provide a refreshed and well-groomed appearance. Between 2006 and 2008, the Indian cosmetics industry grew by 7.48%, driven by increased fashion awareness and higher consumer spending power. Today, people prefer hand-washing soap that is convenient to carry. One innovative product in this category is paper soap, which is molded or printed to be as thin as paper and dissolves in water to create foam. Due to its small size and lightweight nature, paper soap is commonly used as a disposable hand-washing option, making it ideal for outdoor activities.

Paper soap is a dry, lightweight sheet of soap that dissolves within seconds when exposed to a small amount of water. It is a convenient, pocket-sized product that can be used for cleaning both hands and face. Nowadays, people prefer hand-washing soap that is easy to carry, and paper soap represents an innovative solution, as it is as thin as paper and turns into foam when it comes into contact with water. Due to its compact size, paper soap is typically used as a disposable hand-washing option, making it ideal for outdoor activities. Soap is traditionally made from fats and alkali, with the cold process method being the most popular soap-making technique today, though some manufacturers still use the traditional hot process method.

Maintaining health and hygiene is crucial due to the rising number of diseases caused by microorganisms. Since ancient times, soap has been a fundamental component of human hygiene. In the modern era, bath soaps are primarily available in two forms: solid and liquid. People's choice of soap is influenced by various factors, including portability. Paper soap is an innovative formulation that is molded and printed to be as thin as paper. It is essential to have convenient soap options while traveling, and this is where paper

soap becomes particularly useful. When paper soap comes into contact with water, it easily dissolves and produces foam, similar to traditional soaps and gels. Paper soap is primarily produced on a large industrial scale in China and is made from a variety of materials, including methyl paraben, propyl paraben, glycerin, and carbomer. Currently, there are still very few options for paper soap available in the market. Today, people seek hand-washing cleansers that are easy to carry anywhere. Paper cleaner represents an innovative solution, being manufactured as thin as paper and dissolving when exposed to water to create foam.

Nowadays, many people prefer herbal products due to their lack of side effects, which has led to the development of herbal paper cleaners. This study aims to develop and evaluate a multipurpose paper soap incorporating oregano oil, sandalwood oil, and complementary ingredients renowned for their antibacterial and skin-nourishing properties. Sodium lauryl sulfate, a common surfactant in personal care products, facilitates lather formation and effective dirt removal. Olive oil, recognized for its soothing and hydrating properties, nourishes the skin and reduces irritation and inflammation. Shea butter, a humectant, enhances moisturizing properties by attracting and retaining skin moisture.

MATERIAL AND METHODS

Selection of ingredients: The materials and herbs used in this study were selected based on a thorough literature review. The development of paper soap utilized oregano oil, sandalwood oil, olive oil, SLS, shea butter, soap base, ylang-ylang oil, NaCl and colorant chosen through literature review.

1) Oregano oil

Oregano oil, also known as origanum oil, is a natural essential oil extracted from the leaves of the *Origanum vulgare*, *Origanum majorana*. This Oregano oil is renowned for its pungent, earthy, and herbaceous aroma, antimicrobial, antifungal, antioxidant, and anti-inflammatory properties. It can improve skin conditions such as psoriasis, fungal infections

2) Sandalwood oil

Sandalwood oil has been utilized for a variety of purposes throughout history, with its integration into foods, cosmetics, and pharmaceutical products. It offers antimicrobial, anti-inflammatory, and antitoxic protection.

3) Olive oil

Olive oil, oil extracted from the fleshy part of the ripened fruit of the olive tree, *Olea europaea*. Olive oil varies in color from clear yellow to golden; some varieties obtained from unripe fruit have a greenish tinge. Olive oil got moisturizing capacity, cleansing, exfoliating, anti-aging, it is high in vitamin A, E, D and K which can help protect and nourish sensitive skin.

4) Sodium Lauryl Sulfate (SLS)

When handling Sodium Lauryl Sulfate (SLS), utilize proper safety precautions, including gloves and goggles, to prevent skin and eye irritation. To avoid clumping breakdown, keep SLS out of direct sunlight and in a cold, dry location.

5) Shea butter

Shea butter is a natural, rich, and creamy paste extracted from the nut of the shea tree (*Vitellaria paradoxa*). Shea butter is renowned for its moisturizing and emollient properties, anti-inflammatory and antioxidant effects, ability to soothe and protect skin and hair, richness in vitamins A, E, and F, as well as fatty acids.

6) Soap base

A soap base is a pre-made mixture of oils, fats, and alkali (such as sodium hydroxide or potassium hydroxide) that has already gone through the saponification process, which is the chemical reaction that converts oils into soap. It's already saponified, eliminating the need for lye handling. Available in blocks or cubes, soap base is typically made from glycerin, coconut oil, and palm oil. Soap base is ideal for beginners due to its ease of use.

7) Ylang ylang oil

Ylang ylang oil is made from the flowers of *Cananga odorata genuina*. It is sometimes inhaled as aromatherapy or applied to the skin as medicine. Ylang ylang oil is used as a food flavoring and as a fragrance in cosmetics and soaps.

8) Sodium chloride (NaCl)

NaCl commonly known as salt, serves as an essential additive in soap formulation. Its primary functions include enhancing lather stability, improving texture and acting as a natural preservative. NaCl's inclusion in soap recipes also contributes to skin health benefits.

9) Kesari Powder IH 9140

It is a synthetic iron oxide pigment (CI 45410), adds a vibrant reddish-orange hue to soap formulations. This colorant's excellent light-fastness and stability ensure consistent color retention. Ideal for crafting decorative and functional soaps.

10) Water soluble paper

Water soluble paper is a unique type of paper that completely dissolves in water, leaving no residue. It's crafted from special cellulose fibers that break down when exposed to liquid. This property makes it a versatile material with numerous applications. Water Soluble paper is a special variety of paper that biodegrades instantly or after some time with the introduction of water.

**Fig1:Oregano oil****Fig: Sandalwood oil****Fig3: Olive oil****Fig4: Shea butter****Fig5: Soap base****Fig6: Ylang Ylang****Fig7: Water soluble paper****Paper soap formulation:****Table No1:Composition of Paper Soap**

Sl No	INGREDIENTS	F1	F2	F3	F4	F5
1.	Oregano oil	0.01ml	0.001ml	0.01ml	0.001ml	0.001ml
2.	Sandalwood oil	0.005ml	0.005ml	0.02ml	0.02ml	0.02ml
3.	Olive oil	0.01ml	0.001ml	0.01ml	0.001ml	0.001ml
4.	SLS	0.985g	0.994g	0.97g	0.979g	0.979g
5.	Shea butter	5g	5g	5g	5g	5g
6.	Soap Base	75g	75g	75g	75g	75g
7.	Ylang Ylang oil	2ml	2ml	2ml	2ml	2ml
8.	NaCl	1g	1g	1g	1g	1g
9.	Kesari Powder IH 9140	As needed	As needed	As needed	As needed	As needed

PROCEDURE

The quantities of the ingredients were carefully weighed according to specific geometric ratios. A soap disc was created by cutting a piece of water-soluble paper into a round shape with a 4cm diameter. Next, a soap base was melted in a beaker using a water bath. The oil components, comprising Shea butter, oregano oil, olive oil, sandalwood oil, and ylang-ylang oil, were blended together to achieve a consistent mixture, then added to into the beaker. Then NaCl, and SLS were added to the soap base and mixed until all the ingredients were fully incorporated. The mixture was then applied to the water-soluble paper using a dipping process, ensuring an even coating. Finally, the soap disc was left to dry, ready for use.



Fig8: Melting



Fig9: Dipping

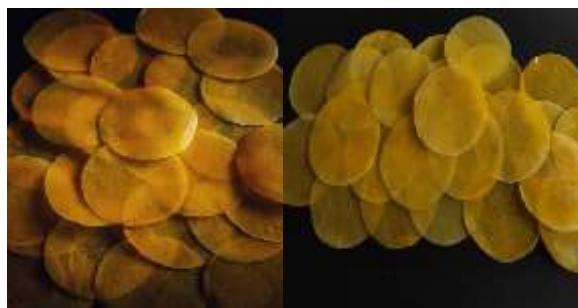


Fig 10 : PREPARED PAPER SOAP STRIP

Different paper soap formulations:



Fig 11: F1



Fig 12: F2

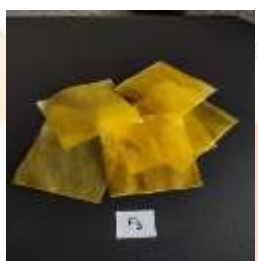


Fig 13: F3



Fig 14: F4



Fig 15: F5

EVALUATION

A). EVALUATION TEST FOR PAPER SOAP

- Size – 4cm
- Shape- Round
- Odour- Aromatic, pleasant.

B).EVALUATION OF LIQUID SOAP, Organoleptic evaluation

- Colour – Orange
- Odour – Pleasant, Aromatic.
- Clarity – The test was done by keeping the liquid soap under the white background

C).PHYSICAL EVALUATION OF PAPER SOAP

1. pH

A small amount of soap was dissolved in distilled water. The pH electrode was immersed in the soap solution and the pH value was read.

Result: The pH was found to be 9.41



Fig 16: pH = 9.41

2. FOAM STABILITY

The sample was dispersed in 20 ml of distilled water, transferred to a measuring cylinder, and shaken for one minute. The foam height was immediately measured and recorded as F1. After 10-15 minutes, the foam height was measured again and recorded as F2. The foam height was calculated by subtracting F2 from F1.

Result: $F1 - F2$



Fig 17: F1=25ml



Fig 18: F2=20ml

Foam initial volume $F1 = 25\text{ml}$

- $F1 = 25\text{cm}$
- $F2 = 20\text{cm}$

Therefore, the foam height was $= 5\text{cm}$

Foam final volume $F2 = 20\text{ml}$

3. SENSITIVITY

A patch test was conducted by applying the product to a 1 cm patch of skin. It was considered free from sensitivity if no inflammation or rashes developed.

Result: Upon application, the soap demonstrated excellent skin compatibility, with no instances of inflammation or irritation reported

4. IRRITATION

The product was applied to the skin for 10 minutes. If no irritation occurred, it was considered a non-irritating product.

Result: Results from a 10-minute skin patch test confirmed the product's non-irritant status, as no signs of irritation or adverse reactions were evident.

5. RESIDUE TEST

A soap strip was taken and washed with water, then it was checked for any remaining residue.

Result: After washing with water, no residue remained

6. PAPER SPREADABILITY

A piece of filter paper was taken, and a small amount of soap sample was applied uniformly to its center. The soap was then spread on the paper using a spatula, and its spreadability was observed.

Result: The soap sample exhibited excellent spreadability, evenly distributing across the filter paper.

7. TOTAL MOISTURE CONTENT

A known weight of the paper soap sample was dried in an oven at a specific temperature (usually 105°C) until a constant weight was reached. The weight loss represented the moisture content.

Result:



Fig19: Before drying = 0.54g



Fig 20: After drying = 0.42g

$$\begin{aligned}
 \text{Percentage of total weight: } & (W_w - W_d) / W_w \times 100 \\
 & = (0.54 - 0.42) / 0.54 \times 100 \\
 & = 22.22\%
 \end{aligned}$$

8. LATHERING TEST

This test evaluates a product's ability to produce foam when mixed with water. It involves rubbing a small amount of the product between wet hands to create lather.

Result: The foam test yielded a positive result, indicating satisfactory foaming ability.



Fig 21



Fig 22

9. STABILITY STUDIES

Stability studies were conducted on samples F1-F5 at various temperatures: Refrigerated (3-5°C), Room temperature (37°C), and Hot air oven (40-45°C). Visual appearance and washability were evaluated.

Table No2: Stability studies table with results

TEMPERATURE	EVALUATION PARAMETERS	OBSERVATIONS				
		F1	F2	F3	F4	F5
3- 5°C Refrigerator	Visual appearance	Orange	Orange	Orange	Light orange	Orange
	Washability	Ineffective cleaning	Effective cleaning	Ineffective cleaning	Effective cleaning	Effective cleaning
37°C Room temperature	Visual appearance	Orange	Orange	Orange	Orange	Orange
	Washability	Ineffective cleaning	Effective cleaning	Ineffective cleaning	Ineffective cleaning	Effective cleaning
40-45°C Hot air oven	Visual appearance	Dark Brown	Orange	Dark Brown	Orange	Orange
	Washability	Ineffective cleaning	Effective cleaning	Ineffective cleaning	Effective cleaning	Ineffective cleaning

Discussion: Stability studies were conducted on five formulations at various temperatures (3-5°C, 37°C, and 40-45°C). Evaluating visual appearance and washability, we found that formulations F1, F3, F4, and F5 underwent color changes and lost effectiveness at certain temperatures. Conversely, F2 demonstrated consistent performance, making it the optimal paper soap formulation.

CONCLUSION

This study successfully developed a multipurpose paper soap incorporating oregano oil, sandalwood oil, and olive oil. The soap demonstrated excellent foaming, spreadability, and moisturizing properties. Results showed significant antibacterial activity and skin-nourishing benefits. Evaluating visual appearance and washability, we found that formulations F1, F3, F4, and F5 underwent color changes and lost effectiveness at certain temperatures. Conversely, F2 demonstrated consistent performance, making it the optimal paper soap formulation. The paper soap's convenience, portability, and eco-friendliness offer advantages over traditional soaps. This innovative product addresses hygiene and skincare needs. Its development

contributes to sustainable personal care solutions. Future research can explore additional natural ingredients and applications. The paper soap's potential benefits warrant further investigation. This study's findings encourage the development of eco-friendly, effective personal care products. Overall, this paper soap offers a promising solution for modern hygiene and skincare.

REFERENCE

1. Asri Widyasanti¹, Anastasia Miracle Lenyta Ginting², Elgina Asyifani³, Sarifah Nurjanah⁴, the production of paper soap from coconut oil, and virgin coconut oil (VCO) with the addition of glycerine as plasticizer, IOP conference series earth and environmental science, 2017.
2. Rahmiati^{*1}, Suciani Zubair¹, Baiq Yusmi Aolinnir Rahmah¹, Ika Mustikasari², Annur Afgoni³, and Erin Ryantin Gunawan¹, formation of antibacterial paper soap from virgin coconut oil and durian seeds, j pijar MIPA: vol.17 no, july 31, 2022.
3. Rahul Kumar Chandel¹, Harish Sharma², Thaneshwar Yadav¹, Amardeep Diwakar², Chandraprabha Dewangan², Prerana Sahu¹, Gyanesh Kumar Sahu², Rajesh Kumar Neema Formation and evaluation of polyherbal paper soap, International journal of enhanced research in medicines and dental care (IJERMDC), kokha, kurud, bhilai, Chhattisgarh, vol.11 issue 5 may 2024.
4. Shreya. P. Ghadage¹, Surekha. P. Khamkar², 1,2 Dept of pharmacy, Late Narayandas Bhawandas Chhabada Institute of Pharmacy, Raigaon, Satara, formulation and evaluation of paper soap from balanites Aegyptiaca, India International Journal of All Research Education and Scientific Methods (IJARESM), ISSN: 2455-6211, Volume 12, Issue 4, April-2024.
5. Ms. Dipali. R. Khandagale¹, Ms. Poonam P. Papule², Mr. Manoj Jaybhaye³, Miss. Didwal Sakshi⁴, Mr. Khase Namdev⁵, formulation and evaluation of paper strips from orange peel extract, 1,2,3,4,5 RMP'S Bhalchandra College of Pharmacy, Khanapur, Pune, volume 6, issue 4, july-august 2024.
6. Fitri Nur Islamiati¹, a), Neneng Windayani¹, b) and Risa Rahmawati Sunarya¹, c) 1 Department of Chemistry Education, UIN Sunan Gunung Djati Bandung, formulation of herbal paper soap from virgin coconut oil with addition of whey kefir, Indonesia, Published Online: 12 March 2023.
7. Dr. Saraswathi, Dr. Kavitha PN, Mahalakshmi Sampagavi, Saurav kumar upadhyay, Bhawna and Priyanka mandal, formulation and evaluation of herbal paper soap, IJPSDA Received: 26-05-2021 Accepted: 05-07-2021
8. Dr. Pravin V. Gomase^{*1}, Dr. R. R. Patil², Dr. Sunil P. Pawar³ IJRPAS, July-August 2022, formulation and evaluation of antibacterial polyherbal paper soap, IJRPAS, Shaha Published: 31/08/2022.
9. Dabhoya Sainbanu, Dalal Kinjal, Dasu Hasnain, Dhakal Harish, Jimisha Kher, Hemangi Gohil, formulation and evaluation of antibacterial paper soap, Gujarat: JETIR april 2023, volume 10, issue 4.
10. Dabhoya Sainbanu, Dalal Kinjal, Dasu Hasnain, Dhakal Harish, Jimisha Kher, Hemangi Gohil, formulation and evaluation of antibacterial paper soap, Gujarat: JETIR april 2023, volume 10, issue 4.
11. Karwate Pratik, Muley. V. R., and Dr. Prachi Udupurkar Kishori College of Pharmacy, Beed Dr. Babasaheb Ambedkar Technological University, Lonere, formulation and evaluation of polyherbal paper soap, © 2023 IJCRT | Volume 11, Issue 5 May 2023.
12. J. Rhoades, Salvatore cervellieri, Thomas netti, vincenzo lippolis and Federico baruzzi, antibacterial activity of oregano essential oil vapors against microbial contaminants of food-contact surfaces, national research council of Italy: pinto L, 18th april 2013
13. Maria Fournomiti, Athanasios Kimbaris, Ioanna Mantzourani, Antibacterial activity of essential oils of cultivated oregano, university of thrace: Maria Fournomiti, 15th april 2015.
14. Samiksha Bachkar, Pratiksha Sonawan, Samiksha Bhaurao Bachkar, preparation of sandalwood beauty products, DKIOP Kolpewadi: Volume 7, Issue 12 December 2022.
15. Malachi oluwaseyi Israel, Effect of topic and dietary use of she'a butter on animals, Ekiti state university, ado-ekiti, Nigeria: malachi oluwaseyi Israel, nov 5th 2014.
16. Joris pinto, Salvatore cervellieri, Thomas netti, vincenzo lippolis and Federico baruzzi, antibacterial activity of oregano essential oil vapors against microbial contaminants of food-contact surfaces, national research council of Italy: pinto L, 18th april 2024.
17. Loh teng hern tan, learn han lee, wai fong yin, chim kei chan, habsah abdul kadir, kok Gan chan, and Bey Hing Goh, Traditional uses, phytochemistry, and bioactivities of cananga odorata (ylang-ylang), university of Malaya, Malaysia: Loh Teng Hern Tan, vol 2015,
18. Jingjing Ji, Mi Jung Kim, Savitha Dhandapani, Jessica Gambino Tjhang, Jun-Lin Yin, Limsoon Wong, Rajani Sarojam, Nam-Hai Chua, and In-Cheol Jang, The floral transcriptome of ylang ylang, national university of Singapore: Jingjing Jin, vol 66, 8th may 2015.