ORIGINAL ARTICLE

Formulation and evaluation of poly herbal transparent soap containing extracts of *Mimusops elengi* L., *Senna auriculata,* and *Ocimum basilicum* oil

K. Sujatha[1], R. Induja[1], C. Hemamalini[1], G. Karthikeyan[1], A. Janani[1], K. Karthick[1], B. Keerthish Sujan[1], S. Sinthiya[1], S. Manoharan[2]

[1]Department of Pharmaceutical Chemistry, Sri Ramachandra Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai, Tamil Nadu, India, [2]Vaccine Research Centre - Bacterial Vaccines, Centre for Animal Health Studies, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Abstract

Introduction: The most common type of skin infection is bacterial skin infection which demands immediate care as well as continuous care to maintain healthy skin. The aim of this study is to formulate a poly herbal transparent soap with the extracts of *Mimusops elengi* L. and *Senna auriculata* as well as oil of *Ocimum basilicum* having antibacterial and antioxidant activity. **Materials and Method:** The 1% and 3% extract of the dried flowers of *M. elengi* L. and *S. auriculata* and *O. basilicum* oil was incorporated into the glycerine base to produce polyherbal transparent soaps in different concentration. The soaps were evaluated for physiochemical parameters as per the BIS standards. The agar well diffusion method was used to test antibacterial activity. The antibacterial activity of the prepared soap and extract was tested against *Staphylococcus aureus* and *Escherichia coli.* **Results:** The physiochemical properties of the transparent soaps were satisfactory. The antibacterial investigation showed that the soap with 3% concentration of the extract showed greater zone of inhibition which showed promising activity against *S. aureus*. When it came to *E. coli*, the product proved less effective. **Conclusion:** The results indicate that the prepared herbal soaps could be a viable alternative to commercially available chemical soaps.

Key words: Herbal, transparent soap, antibacterial, skin care

INTRODUCTION

The skin act as the human body's exterior covering tissue, act as a protective barrier against the loss of water and other vital substances. It is composed of several layers, including sweat glands, blood vessels, nerve endings, hair follicles, and others. The importance of the skin in human health is demonstrated by the fact that it performs a variety of vital physiological functions such as heat regulation. Furthermore, it plays a crucial function in preventing pathogens from entering the body. As a result, skin tissue's anatomical and physiological health are critical for the immunity of human. Skin diseases are common in adolescents and adult skin. Fungi. *Staphylococcus* sp., and *Streptococcus* sp., cause the majority of skin infections, which are treated with antibacterial and antifungal medications in conventional medicines.[1] Herbal skin care products are made from range of plant parts such as leaves, stems, root, bark, and sap. These herbal skin care products are available in a variety of topically applied forms, including creams, lotions, gel, ointment, and soaps. Soaps are a popular vehicle for applying these medicinal herbs on to the skin for external use in the treatment for skin problems. Because of the wide range of personal demands and preferences, soap products such as opaque soap, liquid soap and transparent soap are widely available. Opaque soap

Address for correspondence:
K. Sujatha, Department of Pharmaceutical Chemistry, Sri Ramachandra Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai, Tamil Nadu, India.
E-mail: sujatha.k@sriramachandra.edu.in

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is conventional solid soaps which are not transparent, liquid soaps is soap that is made of liquid and transparent soaps are used for the face and showers and produces softer foam and shiny look. They are several many chemical-based soaps in market which are mostly made of synthetic chemicals, preservatives, and fragrances which are less effective against the microorganism with no healing properties. Plants having antibacterial capabilities have received increased attention, owing mostly to the fact that these plants are thought to be source to pharmacologically active constitutes. The secondary metabolites present in plants includes phenols, tannins, terpenoids, alkaloids, and flavonoids, all of which have been discovered to have antibacterial characteristics.[2] So as a result, there has been a spike in the development of herbal products. Several researches have revealed that extracts of dried flowers of *Mimusops elengi* L. and *Senna auriculata* as well as oil of *Ocimum basilicum*, have pharmacological activity. Various parts of the plants have been evaluated for their pharmacological action based on the literature review.

Taxonomy of *M. elengi* L.

- Kingdom: Plantae
- Class: Magnoliopsida
- Order: Ericales
- Family: *Sapotaceae*
- Genus: *Mimusops* L.
- Species: *M. elengi* L.

Vernacular Names

- English: Bullet wood, Spanish cherry
- Bengali: Bakul
- Tamil: Vagulam, Magadam
- Telugu: Bogada
- Sanskrit: Bakula.[3]

Medicinal Uses of *M. elengi* L.

Phytochemicals such as triterpenoids, carboxylic acid ester, and volatile oil were discovered in the flowers of *M. elengi* L. after chemical analysis. It was reported to have analgesic, antibiotic, antihyperlipidemic, anti-inflammatory, antimicrobial, antioxidant, antipyretic, and cytotoxic properties.[4-6] The flowers are cooling and astringent to the intestines and used to treat blood illnesses, biliousness, liver complaints, nasal ailments, headaches, and asthma. The bark is used as a cooling agent as well as alexipharmic, stomachic, anthelmintic, tonic and astringent to treat biliousness and gum and tooth problems. The fruits are considered healthy for the teeth. The seed part of the plant is used to repair loose teeth and treat headaches. The petals and sepals of *M. elengi* L. flowers shown potential antioxidant activity, which provides anti -aging benefits by lowering oxidative stress.[7,8] The picture of the flowers of *M. elengi* L. is shown in Figure 1.

Taxonomy of *Cassia auriculata*

- Kingdom: Plantae
- Class: Magnoliopsida
- Order: Fabales
- Family: *Fabaceae*
- Genus: *Senna* Mill.
- Species: *S. auriculata* (L) Roxb.[9]

Vernacular Names

- English: Coffee Senna, Coffee weed
- Bengali: Kalkashunda
- Tamil: Nattam Takarai
- Telugu: Thangedu
- Sanskrit: Arimarda
- Malayalam: Mattantakara.

Medicinal Uses of *S. auriculata*

The chemical composition of dried flowers of *S. auriculata* was found to contain terpenoids, tannins, flavonoids, saponins, and steroids. According to a study of the literature, it appears to be a potential antibiotic against bacteria.[10] Due to the presence of flavonoids and tannins, it was also discovered to exhibit antioxidant action.[11] Linalool, estragole, α-bergamotene, eugenol, methyl cinnamate, bicyclosesquiphellandrene, eucalyptol, and γ-cadinene. In Traditional medicine, this plant has been used in treating inflammation, edema, diabetes, liver disease, scabies, skin diseases, and snakebite. On scientific investigations, the plants parts were found to have various pharmacological activities such as anticonvulsant activity, anti-inflammatory activity, anti-microbial activity, cytotoxic activity, and other activities.[9] The image of flowers of *S. auriculata* is shown in Figure 2.

Taxonomy of *O. basilicum*

- Kingdom: Plantae
- Class: Magnoliophyta

Figure 1: Flowers of *Mimusops elengi* L.

- Order: Lamiales
- Family: *Lamiaceae*
- Genus: *Ocimum* L.
- Species: *O. basilicum.*

Vernacular Names

- English: Sweet Basil
- Hindi: Ban tulsi
- Tamil: Tulaciilaikal
- Telugu: Tulasiakulu
- Sanskrit: Thulasha.

The phytochemicals in the essential oil are responsible for antibacterial, antioxidant, and other pharmacological action.[12] Conventionally, this plant is being used in the treatment of cough, headache, worms, diarrhea, and skin infections. The leaves were used as antispasmodic and stomachic. The essential oil was found to have antimicrobial, antioxidant, and anti-inflammatory activity. According to modern medicine, the plant was found to possess anti-spasmodic, anti-diabetic activity, antibacterial, anti-fungal, and anti-oxidant properties[13,14] The image of the sweet basil leaves is shown Figure 3.

The aim of the present study was to prepare novel transparent soap formulations using the extracts of *M. elengi* L., *S. auriculata,* and *O. basilicum* oil and to investigate the antimicrobial activity of the extract against the common microorganisms which cause skin infections. Furthermore, the physiochemical parameters of the transparent soaps were evaluated according to the Indian standards.

Figure 2: Flowers of *Senna auriculata*

Figure 3: Leaves of *Ocimum basilicum*

MATERIALS AND METHODS

Collection of Samples

The dried flower of *M. elengi* L., *S. auriculata,* and essential oil of *O. basilicum* was purchased from the local herb dealer in the month of October 2021.

Preparation of Extracts

About 150 g of dried flowers of *M. elengi* L. and 100 g *S. auriculata* were powdered and stored in air tight container. The powders were then macerated in methanol for 48 h. The macerated sample was then filtered and methanolic extract was collected by distillation.

Preparation of Transparent Herbal Soap

The extracts were added in two distinct concentrations 1% and 3% into the melted glycerine soap base.

Transparent Herbal Soap

The solidified basic glycerine soap was cut into smaller pieces and melted on a water bath. The extract mixtures were added in two distinct concentrations, that is, 1% and 3% into the melted glycerine soap base. For the purpose of fragrance, few drops of sandalwood oil were added to the melted soap base. The melted soap was gently blended for around 30 min before being shaped into various forms using silicon molds. The soap was allowed to firm at room temperature until it was set and any kept under physical observation for any characteristic changes. The formula for the preparation of the polyherbal transparent soap is tabulated in Table 1 and photographs of prepared polyherbal soaps in Figure 4.

Evaluation of Physicochemical Parameters of the Prepared Transparent Soap

To determine the quality of the developed formulations, various physicochemical metrics were applied, as listed below. All the parameters have been evaluated based on the Indian standards specification for transparent toilet soap (IS: 286–1978) and other literatures.

Determination of Clarity, Color, and Odor

The odor was sniffed and the clarity and color were evaluated with naked eyes on a white backdrop.[15]

Table 1: Poly herbal soap formulation

Ingredients	Quantity
Extract 1 *Mimusops elengi* L.	1% and 3%
Extract 2 *Cassia auriculata*	1% and 3%
Oil of *Ocimum basilicum*	0.2 ml
Glycerine base	100 g
Sandalwood oil	q.s

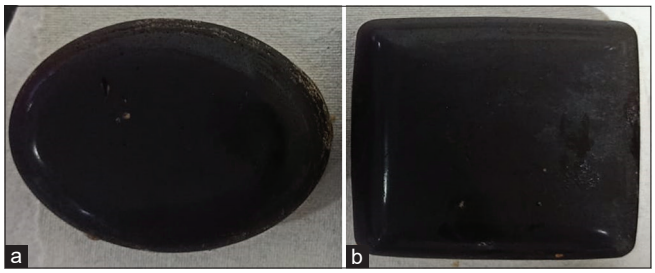

Figure 4: Photographs of polyherbalsoaps (a) poly herbalglycerine soap made of 1% of plant extracts (b) polyherbal glycerine soap made of 3% of plant extracts

Determination of pH

A digital pH meter was used to determine the pH of the prepared transparent soap. The formulations were diluted with 100 ml of distilled water. The pH of the formulation was measured using a previously calibrated pH meter.[15]

Determination of Percentage Free Alkali

5 g of sample was taken in Erlenmeyer flask and 50 ml of neutralized alcohol was added. It was boiled under reflux on a water bath for 30 min, cooled and few drops of phenolphthalein solution were added. It was then titrated immediately against 0.1 N KOH.[15]

Determination of Foam Height

A sample of 0.5 g of soap of both concentration (1% and 3 %) was obtained and dispersed in 25 ml of distilled water. Then, it was poured into a 100 ml measuring cylinder, diluting it to 50 ml with water. 25 strokes were made and let to stand until the aqueous volume reach 50 ml, at which point the foam height was measured above the aqueous liquid.[15]

Determination of Foam Retention

A 100 ml graduated measuring cylinder was filled with 25 ml of 1% soap solution. It is hand shaken for 10 times. For every 4 min, the volume of foam was measured at 1 min interval. The height of foam was visually measured.[16]

Alcohol Insoluble Matter

In a conical flask, 2 g of sample material was taken and dissolved in 50 ml warm ethanol with vigorous shaking. With 20 ml warm ethanol, the solution was filtered through tarred filter paper and dried in the oven at 105°C for 1 h. The weight of dried filter paper was weighed and noted.[17]

Formula

% alcohol insoluble matter = Wt. of residue×100/Wt. of sample

Determination of Moisture/Water Content

5 g of sample was placed in a petri dish and dried for 2 h in the hot-air oven at 105°C. It was cooled and weighed after the heating. The difference in weight indicates the loss of moisture.[17]
Water content = m/M*100
m = loss in mass of the material after drying
M = mass of sample taken.

Determination of Unsaponifiable Matter

5 g of sample was weighed and placed it in 200 ml conical flask. Boiled for 1 h under a reflux condenser with 30 ml of 95% ethyl alcohol and 5 ml potassium hydroxide solution. The contents were washed with 95% ethyl alcohol and transferred to a separating funnel. Using the warm and cold water the transfer of content was finished. Petroleum ether was used and transfer process was repeated. The contents were cooled before mixing in 50ml petroleum ether. After the completion of extraction, the residues were weighed.[17]

Calculation

Unsaponifiable matter, percent by mass = $100(M_1–M_2)/M_3$

where
M_1 = mass in g of the residue,
M_2 = mass in g of the fatty acids,
M_3 = mass in g of the material taken for the test.

Preliminary Antimicrobial Screening of the Extracts

The antibacterial activity of the extract and prepared soaps was evaluated using the agar well diffusion technique against *Escherichia coli* isolated from peacock and cattle as well as *Staphylococcus aureus* isolated from dog and cattle. The test was carried out on the solid medium's surface. The soap solution-soaked paper disc was put on the surface and incubated for 24 h. The zone of inhibition was assessed after the incubation period.[16]

RESULTS AND DISCUSSION

The physicochemical parameters of the formulated herbal soap were tested at various concentrations. Color, odor,

Table 2: Results of physicochemical parameters

Soap sample	Color	Odor	pH	Foam height (ml)	Foam stability (%)	% free alkali	Total moisture content (%)	Alcohol insoluble matter (%)	Unsaponifiable matter (%)
1% SOAP	Dark brown	Aromatic	7.3	50	48.3	0.04	25	71	18
3% SOAP	Dark brown	Aromatic	7.3	50	50.7	0.05	23	73	20

Table 3: Antimicrobial screening of transparent soap

Organism	Zone of inhibition (mm)					
	1% SOAP	3% SOAP	Extract of *Mimusops elengi* L.	Extract of *Senna auriculata*	Commercial soap	Standard
Staphylococcus aureus (cattle)	12	20	16	16	12	24
E. coli (peacock)	10	12	12	16	0	24
Staphylococcus aureus (Dog)	12	12	14	20	9	40
E. coli (cattle)	9	10	16	20	10	28

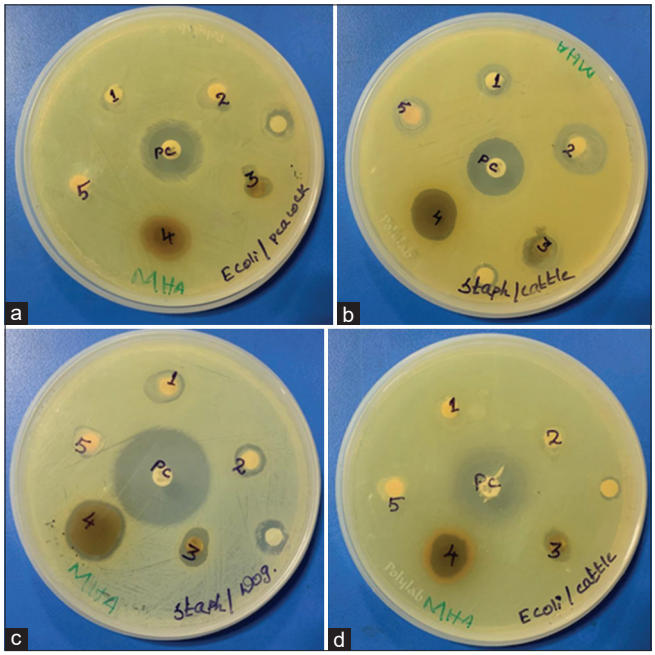

Figure 5: The pictures show the zone of inhibition results of sample against (a) *Escherichia coli* (peacock) (b) *Staphylococcus aureus* (cattle) (c) *Staphylococcus aureus* (Dog) (d) *E. coli* (cattle). (1) 1% soap; (2) 3% soap; (3) *Mimusops elengi* L. extract; (4) *Cassia auriculata* extract; (5) market soap; PC-control

and pH were evaluated and determined to be in compliance with the specification. The pH was in the range of 6.0–7.5. Other characteristic including foam height, foam stability, total moisture content, % free alkali, and alcohol insoluble matter was measured and determined to be within acceptable limits. The results of the parameters are tabulated in Table 2.

Antimicrobial Screening of the Extracts and Formulation

The methanolic extract of *M. elengi* L. and *S. auriculata* was discovered to exhibit antibacterial activity in the literature. Antibacterial activity was also reported in the essential oil of *O. basilicum*. The extract was added to the formulation at two distinct concentrations, namely, 1% and 3%. The extracts used in the formulation showed significant antibacterial activity. Both samples had a strong inhibitory concentration zone. The 3% extract soap had a substantial impact on *S. aureus* inhibitory diameter. When compared to the extract of dried flowers of *S. auriculata*, the dried flower extract of *M. elengi* L. displayed a larger zone of inhibition against *S. aureus*. The commercial samples exhibited less antibacterial activity than the prepared soaps. The zone of inhibition of samples against the microbes is given in Table 3. The pictures of the antibacterial investigation of the samples against the microbes are shown in Figure 5.

CONCLUSION

Because of its higher polarity and pharmacological activity methanol was used to extract the fried flowers of *M. elengi* L., *S. auriculata*. Based on the literature assessment, the essential oil of *O. basilicum* was used in the formulation due to its pharmacological action. The antimicrobial activity of soaps made in two different concentrations was examined and the soap with 3% concentration was shown to have high antibacterial activity against *S. aureus* than against *E. coli*. Furthermore, physiochemical properties such as pH, color, moisture content, % alkali, and other parameters were standardized and assessed on the formulated soap, produced

good results. As a consequence of the findings, it can be concluded that adding extract to manufactured soap has a promising antibacterial impact while having no influence on physicochemical characteristics. The formulated herbal soap can be used as a substitution for commercially available chemical toilet soaps.

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REFERENCES

1. Dryden MS. Skin and soft tissue infection: Microbiology and epidemiology. Int J Antimicrob Agents 2009;34:2-7.
2. Pasdaran A, Hamedi A. Natural products as source of new antimicrobial compounds for skin infections. In: The Microbiology of Skin, Soft Tissue, Bone and Joint Infections. United States: Academic Press; 2017. p. 223-53.
3. Kadam PV, Yadav KN, Deoda RS, Shivatare RS, Patil MJ. *Mimusops elengi*: A review on ethnobotany, phytochemical and pharmacological profile. J Pharmacogn Phytochem 2012;1:64-74.
4. Rani S, Rahman K. Molsari (*Mimusopselengi* Linn.): A boon drug of traditional medicine. Int J Pharm Sci Res 2017;8:17.
5. Gami B, Pathak S, Parabia M. Ethnobotanical, phytochemical and pharmacological review of *Mimusops elengi* Linn. Asian Pac J Trop Biomed 2012;2:743-8.
6. Arifin B, Nasution R, Novi Desrianti MM, Helwati H. Antimicrobial activity of hand lotion of flower *Mimusops elengi*. Open Access Macedon J Med Sci 2019;7:3748.
7. Natungnuy K, Poeaim S. Antioxidant and cytotoxic activities of methanolic extracts from *Mimusops elengi* flowers. Int J Agric Technol 2018;14:731-40.
8. Masaki H. Role of antioxidants in the skin: Anti-aging effects. J Dermatol Sci 2010;58:85-90.
9. Mahanthesh MC, Manjappa AS, Sherikar AS, Disouza JI, Shinde MV. Biological activities of *Cassia occidentalis* Linn: A systematic review. World J Pharm Res 2019;8:100-17.
10. Maneemegalai S, Naveen T. Evaluation of antibacterial activity of flower extracts of *Cassia auriculata*. Ethnobotanical Leaflets 2010;2010:3.
11. Kumaran A, Karunakaran RJ. Antioxidant activity of *Cassia auriculata* flowers. Fitoterapia 2007;78:46-7.
12. Ahmed AF, Attia FA, Liu Z, Li C, Wei J, Kang W. Antioxidant activity and total phenolic content of essential oils and extracts of sweet basil (*Ocimum basilicum* L.) plants. Food Sci Hum Wellness 2019;8:299-305.
13. Joshi RK. Chemical composition and antimicrobial activity of the essential oil of *Ocimum basilicum L.* (sweet basil) from Western Ghats of North West Karnataka, India. Ancient Sci Life 2014;33:151.
14. Shahrajabian MH, Sun W, Cheng Q. Chemical components and pharmacological benefits of Basil (*Ocimum basilicum*): A review. Int J Food Propert 2020;23:1961-70.
15. Afsar Z, Khanam S. Formulation and evaluation of polyherbal soap and hand sanitizer. Int Res J Pharm 2016;7:54-7.
16. Anggraini T, Didi Ismanto S, Dahlia D. The making of transparent soap from green tea extract. Int J Adv Sci Eng Inform Technol 2016;5:349-56.
17. Indian Standard specification for transparent toilet soap, (IS: 11303-1985-1-15)

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