

**FORMULATION OF A NATURAL HANDWASH INCORPORATING
MADHUCA LONGIFOLIA AND ITS ANTIMICROBIAL ASSESSMENT**

¹Mr. Chaitanya Hanmant Bansode, ²Dr. Rajesh Wankhede, ³Ms. Prajakta Parasharam Shinde, ⁴Ms. Suvarna Jagannath Shelke, ⁵Ms. Dhanshree Mohite

¹Research Scholar, SMBT Ayurved College, Dhamangaon, Nashik.

²HOD, Department -Dravyagunavigyan, SMBT Ayurved College, Dhamangaon, Nashik.

³Assistant Professor, SMBT College of Pharmacy, Dhamangaon.

⁴Assistant Professor, SMBT College of Pharmacy, Dhamangaon, Nashik.

⁵Research Scholar, SMBT College of Pharmacy, Dhamangaon, Nashik.

Article Received on 29 Feb. 2026,
Article Revised on 19 March 2026,
Article Published on 01 April 2026,

<https://doi.org/10.5281/zenodo.19336780>

***Corresponding Author**

Mr. Chaitanya Hanmant Bansode

Research Scholar, SMBT Ayurved
College, Dhamangaon, Nashik.



How To Cite This Article: ¹Mr. Chaitanya Hanmant Bansode, ²Dr. Rajesh Wankhede, ³Ms. Prajakta Parasharam Shinde, ⁴Ms. Suvarna Jagannath Shelke, ⁵Ms. Dhanshree Mohite. (2026). Formulation of A Natural Handwash Incorporating Madhuca Longifolia And Its Antimicrobial Assessment. World Journal of Pharmacy and Pharmaceutical Sciences, 15(4), 710–721.

This work is licensed under Creative Commons Attribution 4.0 International license.

ABSTRACT

Hand hygiene plays a vital role in preventing the spread of infectious diseases. The increasing concerns regarding the side effects of synthetic handwash products have led to a growing interest in herbal alternatives. The present study focuses on the formulation and evaluation of a herbal handwash prepared from *Madhuca longifolia* (Mahua) with emphasis on its antimicrobial activity. The extract was obtained by aqueous maceration of dried flowers and incorporated into a gel-based handwash formulation using Carbopol-940, glycerin, sodium lauryl sulphate, and other excipients. The prepared formulations were evaluated for physicochemical parameters such as pH, viscosity, spreadability, foam height, and stability. The pH of the formulation was found to be within the skin-friendly range (6.27), indicating its suitability for topical application. The handwash exhibited good foaming ability, stability, and acceptable consistency. Antimicrobial activity was

assessed using the agar well diffusion method against *Staphylococcus aureus* and *Escherichia coli*. The formulation showed significant zones of inhibition, comparable to standard commercial handwash products. The results suggest that *Madhuca longifolia*-based herbal

handwash is effective, safe, and eco-friendly. Thus, it can be considered a promising natural alternative to synthetic antimicrobial handwash formulations.

INTRODUCTION

Traditional medical systems have been built on natural remedies. These medications are seen to be interesting candidates for the creation of novel medications due to their possible pharmacological characteristics.^[1] More than 75% of the population in developing countries remains dependent on traditional medicine. Scientific research has demonstrated that phytochemicals provide a wide range of therapeutic advantages and safety, frequently with fewer adverse effects than synthetic compounds. Therefore, it is crucial to improve the assessment of plants with medicinal attributes.^{[1][2]} Among various medicinal plants, *Madhuca* sp., such as *M. longifolia*, *M. lactifolia*, *M. indica*, *M. butyracea*, etc. (Family: *Sapotaceae* Subfamily: *Caesalpinioideae*, Genus: *Madhuca*, Order: *Ericaleae*), commonly known as ‘Mahua’ or butternut tree (Mohva, Mohua, Mahva, Irippa, Ippa, Madhukah, Erappe, Iluppai), yield edible flowers and fruits known for their significantly high medicinal value and are highly regarded as a universal remedy in Ayurvedic medicine. This is an evergreen tree, reaching 17 m in height, with a large top, and it is mainly found in Australian forests and Asian as well as the sub-mountainous regions of West Bengal, the Himalaya, Odisha, Madhya Pradesh, Bihar, Uttar Pradesh, and Punjab.^[3] These plants prefer tropical climates and are excellent drought-tolerant. This tree cannot survive under waterlogged conditions. Its hardiness allows it to grow in soil pockets found between rocky crevices and even in degraded, rocky, or salt-affected areas. However, for optimal growth and productivity, it prefers well-drained, deep loamy soil.^[4] This plant can be self-sown or cultivated.^[4] The flowering of this tree blooms from the seasons of March to April every year.^[4] *M. longifolia*, is an important economic tree that is abundant all over India.^[5] The number of mahua trees that the households owned varied from 4.5 (in Nabarangpur) to 9 (in Angul). The annual income from ‘NTFPs excluding Mahua’ was highest in Koraput (Rs. 5412/Kg) and lowest in Bolangir (Rs. 1072/kg). In contrast, the annual income from flowers and seed oil of Mahua peaked in Bolangir (Rs. 22306/kg) and was lowest in Baleswar (Rs. 7631/kg). Mahua products contributed the most to overall income in Bolangir (95.49%) and the least in Nuapada (60.23%). Similarly, when considering total income generated from all sources, Mahua products were found to be maximum in Sundargarh (21.94%) and minimum in Baleswar (14.12%). Mahua was found providing critical subsistence to the forest fringe dwellers during lean seasons and is being used for a variety of uses for not only household

consumption but also for sell, however, the earning from various mahua products has not been satisfactory in Odisha as it is not a freely tradable non-timber forest product although it has good prospective to make a better living to rural households.^[6] Moreover, this species is protected by the forest inhabitants and has great religious significance in tribal culture due to its enormous ecological and economic significance.^[9] Since ancient times, various parts of *M. longifolia* have been used to make soap, alcoholic beverages, and cattle feed. Fermentable sugars found in *M. longifolia* flowers are used as a natural sweetener in various regional recipes, including kheer, halwa, burfi, jam, jelly, pickles, and more.^[7] In several recipes, the flowers are also used as a flavouring ingredient.^[8] In rural areas, the edible oil extracted from the seeds is used for cooking^[9] and for making soap and candles.^[10] Various parts of *Madhuca* are used in the preparation of various traditional medicines. Oil extracted from the *Madhuca* seed is used as an edible oil and has shown impressive results in antioxidant and antimicrobial properties.^{[11][12]} The leaves of *M. longifolia* are among the resources employed in the treatment of Cushing's disease and bronchitis and have antioxidative power.^{[13][14]} The bark is a remedy for edema, itching, snake venom, and diabetes.^[15] Phytochemicals are among the factors that influence certain physical processes in the human body.^[16] These are, on the one hand, classified into two groups: primary and secondary constituents, based on their regulatory roles in plant metabolic pathways.^[12] They mostly include polysaccharides, proteinogenic amino acids, proteins, and chlorophylls, with secondary groups of enzymes comprising alkaloids, terpenes, saponins, phenolics, flavonoids, and tannins, among others. Mahua is still underutilized in terms of its economic potential, despite its widespread use and cultural veneration, particularly in areas like Odisha, where it lacks proper market integration but significantly boosts rural income.^[6] The need to compile scientific understanding about the *Madhuca* species is increasing due to its rich phytochemistry, ecological adaptability, and medicinal significance.

Madhuca indica is been gifted with the antioxidant activity which is necessary to combat the oxidative stress due to free radicals. The free radicals are responsible to damage chemical species making the other molecules unstable like superoxide anion (Reactive oxygen species).^[17]



Figure 1: (a) Tree of (b) Flowers of *Madhuca longifolia* *Madhuca longifolia*.

Taxonomy

Kingdom: Plantae

Order: Ericaleae

Family: Sapotaceae

Genus: *Madhuca*

Species: *longifolia*

Hand hygiene is one of the most effective measures for preventing the transmission of infectious diseases. Microbial infection has emerged as a critical issue in children and hospital care outcome, which can lead to substantial morbidity and mortality. Unhygienic hands of health care workers are the primary routes of transmission of infection directly to patients and in children it can lead to several serious health issues. So that, it brings up the use of antiseptic for hand washing purposes. There are several commercial antiseptic available in market having chemical sanitizers as a base which has some disadvantages, adverse and side effects. Conventional handwashes often contain synthetic surfactants and antimicrobial agents that may cause skin irritation and environmental concerns upon prolonged use. Herbal formulations provide a safer and eco-friendly alternative. *Madhuca longifolia* (Mahua), belonging to the family Sapotaceae, is widely used in traditional medicine for its antimicrobial, anti-inflammatory, and emollient properties. The presence of natural saponins makes it particularly suitable for cleansing formulations. The present work aims to formulate a herbal handwash using *Madhuca longifolia* extract and evaluate its antimicrobial potential. Their frequent and longtime use can lead to some side effects and skin irritation. *Madhuca indica* is one of the most widely used and well-documented medicinal plants in the world. Present study aimed to formulate effective, safe and nontoxic

herbal hand wash using Flowers of *Madhuca indica* emphasis on safety and efficacy and to avoid the risk posed by synthetic antimicrobials. Disc diffusion method was utilized for evaluation of the antimicrobial activity against skin pathogens of the prepared herbal hand. Its efficacy was checked and compared with the standard commercial hand wash. Results revealed that *Madhuca indica* based formulation was more efficient in reducing the number of organisms from hands than the commercial antiseptic soaps thus it can be used as an antiseptic soap based handwash with less or no side effects.

MATERIALS AND METHODS

a. Collection of plant materials

The *Madhuca longifolia* plants collected from the area of Tal. Kalvan Forest, District Nashik.

b. Preparation of extraction

The dried plant material of *Madhuca longifolia* was coarsely powdered. About 50 g of the powder was subjected to cold maceration with aqueous extraction for 24–48 hours with occasional stirring. The extract was filtered and concentrated to obtain a clear extract, which was used for formulation.



C. Preparations of herbal hand wash formulations

Table 1: Preparations of herbal hand wash formulations.

Sr. No	Composition %W/V	Ingredient Role	Quantity	
			F1 Batch	F2 Batch
1	<i>Madhuca longifolia</i> Extract	Extract	5	5
2	Carbopol-940 (gm)	Dispersion	0.2	0.4
3	Glycerin (ml)	Humectant	2.0	2.0
4	Sodium Lauryl Sulphate (gm)	Surfactant	2.0	2.0
5	Methyl Paraben (ml)	Preservative	0.2	0.2
6	Triethanolamine (q.s.)	pH Adjustment	qs	qs
7	purified water up to in ml	Vehicle	100	100

d Method of Preparation of Herbal Handwash (Using Given Formula)

The herbal handwash was prepared by initially dispersing the required quantity of Carbopol-940 in approximately 50 mL of purified water with continuous stirring to avoid lump formation. The dispersion was allowed to hydrate for about 30–45 minutes to obtain a clear gel base. Separately, 5 g of *Madhuca longifolia* extract was dissolved in a small quantity of purified water, to which Glycerin (2.0 mL) was added as a humectant and mixed thoroughly. Sodium lauryl sulphate (2.0 g) was then incorporated slowly with gentle stirring to minimize foam formation, followed by the addition of methyl paraben (0.2 mL) as a preservative. This herbal mixture was gradually added to the hydrated Carbopol gel with continuous stirring to ensure uniformity. Triethanolamine was added dropwise to neutralize the Carbopol and to achieve gel formation along with the desired viscosity, while maintaining the pH in the range of 5.5–6.5. Finally, the volume was made up to 100 mL with purified water and the formulation was stirred gently to obtain a homogeneous and stable herbal handwash.

EVALUATION TEST FOR AN HERBAL HAND WASH

- a) **Organoleptic characteristics:** Appearance Colour, odor, the flowers extract in aqueous solvent.
- b) **Phytochemicals (Flavonoids) test:** the extract determined for their flavonoids content as a crude that is highly potent and effective moiety in the cure of many medical conditions.
- c) **Foam Height** 1gm of sample handwash was taken and dispersed in 50ml of distilled water. Dispersion was transferred to 500ml measuring cylinder. The volume was made up to 100ml with water. 25 strokes were given and kept it aside. The foam height above the aqueous volume was noted.
- d) **Stability test** -The stability studies were carried out for hand wash formulation by storing at different temperature conditions for 7 days.
- e) **PH test** -1 gm of handwash was mixed with 100ml of distilled water. The PH of mixture was examined using a PH meter.
- f) **Foam retention** -50ml of herbal hand wash was taken into 250ml graduated cylinder and shaken ten times. The volume of foam at 1-minute interval for minute was recorded foam retention should be stable at least 5 min.
- g) **Spreadability test:** A sample of 0.5g of each formula was pressed between two slides and left for about 5 minutes where no more spreading was expected diameters of spreaded circles were measured in cm and were taken as comparative values for spread ability.
- h) **Viscosity:** The viscosity of hand wash was determined by using Brookfield viscometer.

Measured quantity of herbal hand wash was taken into beaker and the tip of viscometer was immersed into the hand wash.

- i) **Antimicrobial Activity:** The antimicrobial activity was evaluated using the agar well diffusion method against selected microorganisms such as *Staphylococcus aureus* and *Escherichia coli*. The zone of inhibition produced by the herbal handwash was measured and compared with a standard handwash.

RESULT AND DISCUSSION

- a) The extracts is exhibited pale colour. While order was observed as characteristic.

The following table represents the comparison profile

Features	Aqueous flower extract
Appearance	Heterogenous
Colour	Pale
Odor	Characteristic

- b) **Phytochemicals (Flavonoids) test:** aqueous extract demonstrated the absence of flavonoids. The outcome of this test was given in following table-

Test	Aqueous flower extract
Flavonoids test	Observation: Presence of yellow colour indicates that the presence of flavonoids in the plant extract-Inference: Not present

- c. **Foam Height and Retention:** The foaming ability and foam retention of the handwash formulation were evaluated, as these properties contribute to the overall user experience and cleansing efficacy. The initial foam height generated upon vigorous shaking was found to be 12.5 ± 0.8 cm. The foam retention was monitored for four minutes, and the foam volume remained stable, with a gradual decrease of approximately 20% after four minutes. The presence of the extract, which contains saponins, contributed to the foaming properties of the handwash, enhancing its cleansing ability.



Fig.2. Foam Height and Retention.

- d. Stability Studies:** The herbal handwash formulation was subjected to stability studies under different temperature and humidity conditions to assess its shelf-life and ensure the maintenance of its physicochemical properties and antimicrobial activity over time. After three months of storage, no significant changes in appearance, color, odor, or phase separation were observed. The pH and viscosity values remained within the acceptable ranges, indicating the formulation's stability.
- e. pH Measurement:** The pH of the herbal handwash formulation was found to be 6.27 ± 0.12 , which is within the acceptable range for topical formulations intended for skin application. A slightly acidic pH is desirable as it mimics the natural pH of the skin, which ranges from 4.5 to 6.5. Maintaining a pH close to the skin's pH helps preserve the skin's acid mantle, which serves as a protective barrier against microbial invasion and maintains the skin's moisture balance.



Fig. 3: pH Measurement.

- f. Spreadability test:** The spreadability of the polyherbal handwash was evaluated to ensure efficient application and distribution on the skin during handwashing. The formulation exhibited good spread ability, with a spread diameter ranging from 6.5 to 7.2 cm after one minute. Adequate spreadability is crucial for effective cleaning and antimicrobial action, as it allows the active ingredients to come into contact with a larger surface area of the skin.

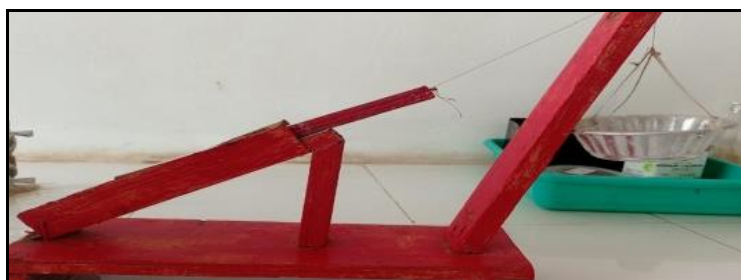


Fig. 4: Spreadability test.

- g. Viscosity:** The viscosity of the herbal handwash formulation was measured to be in the range of 39.68 mPa.s -100 rpm at room temperature. This viscosity range is considered suitable for handwash formulations, as it ensures easy dispensing and spreading on the skin while providing a desirable thickness and body to the product. The viscosity can be attributed to the combined effects of the plant extracts, glycerine, and other ingredients used in the formulation.



Fig. 5: Viscosity test.

- h. Antimicrobial Activity:** The antimicrobial efficacy of the herbal handwash was evaluated against two clinically relevant skin pathogens, *Staphylococcus aureus* and *Escherichia coli*, by agar plate method. The results were compared with a commercially available handwash as a positive control.

Table 2: Evaluation of herbal handwash.

Sr.No	Evaluation Parameter	Observed Values
1	Colour and odour	Pale yellow
2	Homogeneity	Homogenous
3	pH	6.27
4	Viscosity Cps	39.68 mPa.s
5	Spreadability gm.cm/sec	6.5 to 7.2 cm
6	Foam height	150 ml
7	Foam Retention	25 ml
8	Stability	Stable
9	Antimicrobial study-	zone of inhibition showed that the hand wash prepared from Hydroalcoholic extract shown significant antimicrobial activity

ADVANTAGES OF HERBAL HAND WASH

- 1) No toxic side effects.
- 2) It helps to remove dirt and oil from skin.
- 3) Minimized the formation of bacteria.
- 4) Easier access compared to using soap.
- 5) It prevents germs by washing hands regularly.
- 6) Helps to get rid of microorganisms.
- 7) It is a better option compared to synthetic handwashes with antiseptic and anti-fungal properties.
- 8) Totally herbal ingredients.
- 9) Animal testing not required.
- 10) Safe to use.
- 11) Soften and nourishes skin naturally.
- 12) Less expensive.
- 13) Increased efficiency.

RESULTS AND DISCUSSION

The herbal handwash showed acceptable physical characteristics with a pleasant odor and good consistency. The pH was found to be within the skin-friendly range (6.27). The formulation (F2 Batch) exhibited satisfactory foaming ability and foam stability due to the presence of natural saponins. Antimicrobial studies revealed significant zones of inhibition against tested microorganisms, indicating effective antimicrobial activity of *Madhuca longifolia*, confirming the safety of the formulation.

CONCLUSION

The study concludes that a herbal handwash formulated using *Madhuca longifolia* possesses good cleansing properties and significant antimicrobial activity. The formulation is safe, effective, and can serve as a natural alternative to synthetic handwash products. Further studies on long-term stability and large-scale production can enhance its commercial applicability.

REFERENCECS

1. J. K. Grover, S. Yadav, and V. Vats, "Medicinal plants of India with anti-diabetic potential," *J. Ethnopharmacol.*, 2002; 81(1): 81–100, doi: [https://doi.org/10.1016/S0378-8741\(02\)00059-4](https://doi.org/10.1016/S0378-8741(02)00059-4).

2. N. K. Dubey, R. Kumar, and P. Tripathi, "Global promotion of herbal medicine: India's opportunity," *Curr. Sci.*, 2004; 86(1): 37–41, Accessed: Mar. 15, 2026. [Online]. Available: <http://www.jstor.org/stable/24109515>
3. M. F. Ramadan, G. Sharanabasappa, S. Parmjyothi, M. Seshagiri, and J.-T. Moersel, "Profile and levels of fatty acids and bioactive constituents in mahua butter from fruit-seeds of buttercup tree [*Madhuca longifolia* (Koenig)]," *Eur. Food Res. Technol.*, 2006; 222(5): 710–718, doi: 10.1007/s00217-005-0155-2.
4. V. Bisht, V. K. Solanki, and N. Dalal, "Mahua an important Indian species : A review," 2018; 7(2): 3414–3418.
5. N. Verma, K. K. Jha, U. Kumar, K. Deepak, N. K. Singh, and A. K. Singh, "Biological Properties, Phytochemistry and Traditional Uses of Mahua (*Madhuca longifolia*): A Review," 2014; 2(3): 630–638.
6. Pala nazir kumar munesh, *Diversity and dynamics in forest ecosystems*.
7. S. Behera, R. C. Mohanty, and R. C. Ray, "Ethanol production from mahula (*Madhuca latifolia* L.) flowers with immobilized cells of *Saccharomyces cerevisiae* in *Luffa cylindrica* L. sponge discs," *Appl. Energy*, 2011; 88(1): 212–215, doi: <https://doi.org/10.1016/j.apenergy.2010.07.035>.
8. A. Shrivastava, "A STUDY ON PROMOTION / BRANDING OF MAHUA (MADHUKA LONGIFOLIA) IN CHHATTISGARH," 2018; 332–336.
9. S. Manoj, "Forest flowers to rural power:tribal enterprenurship around mahua".
10. O. P. Sidhu, H. Chandra, and H. M. Behl, "Occurrence of aflatoxins in mahua (*Madhuca indica* Gmel .) seeds : Synergistic effect of plant extracts on inhibition of *Aspergillus flavus* growth and aflatoxin production," 2009; 47: 774–777, doi: 10.1016/j.fct.2009.01.001.
11. A. Gupta, R. Chaudhary, and S. Sharma, "Potential Applications of Mahua (*Madhuca indica*) Biomass," 2012; 175–189, doi: 10.1007/s12649-012-9107-9.
12. H. Khas, "Flowers of *Madhuca indica* J. F. Gmel .: Present status and future perspectives," vol. 1, no. December, 2010; 438–443.
13. A. Id and C. Author, "Antimicrobial and Anti-inflammatory Activities of Bark of Four Plant Species from Indian Origin Antimicrobial and Anti-inflammatory Activities of Bark of Four Plant Species from Indian Origin," 2012; 1–14.
14. T. S. Inganakal and P. Swamy, "Evaluation of in Vitro antioxidant activity of a triterepne isolated from *Madhuca Longifolia* L leaves," *Int. J. Pharm. Pharm. Sci.*, 2013; 5: 389–391.

15. A. P. Dahake, C. Chakma, D. Joshi, R. Chakma, and A. Tripathi, "Available online through Antioxidant activity of methanolic extract of *Madhuca longifolia* bark," 2010; 3(8): 1709–1711.
16. A. C. Akinmoladun, E. O. Ibukun, E. Afor, E. M. Obuotor, and E. O. Farombi, "Phytochemical constituent and antioxidant activity of extract from the leaves of *Ocimum gratissimum*," May, 2007; 2: 163–166.
17. P. Khare, K. Kishore, and D. K. Sharma, "Review Article Medicinal uses, Phytochemistry and Pharmacological profile of *Madhuca longifolia*," 2018; 4(5): 570–581.