

# FORMULATION AND EVALUATION OF A HERBAL PURPLE TOOTHPASTE USING WRIGHTIA TINCTORIA, PONGAMIA PINNATA, AND SYZYGIUM CUMINI FOR OPTICAL COLOUR CORRECTION OF TEETH

Arjun S.\*, Mohamed Arshak A., Mohamed Shafeek A., Madhan Kumar K., Meera  
Mahalakshmi R., Babu Thandapani, Ramkumar S.

Assistant Professor, Pharmaceutics, Ultra College of Pharmacy, Madurai, India.

Article Received: 13 August 2026 | Article Revised: 03 September 2026 | Article Accepted: 23 September 2026

**\*Corresponding Author: Arjun S.**

Assistant Professor, Pharmaceutics, Ultra College of Pharmacy, Madurai, India.

DOI: <https://doi.org/10.5281/zenodo.23054210>

**How to cite this Article:** Arjun S., Mohamed Arshak A., Mohamed Shafeek A., Madhan Kumar K., Meera Mahalakshmi R., Babu Thandapani, Ramkumar S. (2026) FORMULATION AND EVALUATION OF A HERBAL PURPLE TOOTHPASTE USING WRIGHTIA TINCTORIA, PONGAMIA PINNATA, AND SYZYGIUM CUMINI FOR OPTICAL COLOUR CORRECTION OF TEETH. World Journal of Pharmaceutical Science and Research, 5(10), 234-248.



Copyright © 2026 Arjun S. | World Journal of Pharmaceutical Science and Research.

This work is licensed under creative Commons Attribution-NonCommercial 4.0 International license (CC BY-NC 4.0).

## ABSTRACT

Conventional toothpastes rely on synthetic antimicrobials, abrasives and artificial dyes that, with prolonged use, are associated with tooth sensitivity, mucosal irritation and altered taste, which has renewed interest in herbal dentifrices built around plant-derived bioactive compounds. “Purple” or “blue-light” toothpastes are a recent category that whiten teeth optically — by depositing a violet pigment on the enamel pellicle that counteracts the yellow tone of the tooth surface via complementary-colour theory — rather than by chemical bleaching. This review discusses the formulation and evaluation of a herbal purple toothpaste in which *Syzygium cumini* (Jamun) seed/fruit extract was used as a natural source of violet-purple pigment in place of synthetic dyes, combined with *Wrightia tinctoria* (Veppalai) leaf extract and *Pongamia pinnata* (Punga) seed/bark extract for their antimicrobial, anti-inflammatory and astringent activity against common oral pathogens responsible for dental caries, gingivitis and periodontitis. The formulated paste was screened for the presence of alkaloids, flavonoids and tannins by Dragendorff's, Shinoda's and ferric-chloride tests respectively, and was evaluated for pH, fineness, foaming index, extrusion, abrasivity, heavy-metal and arsenic limits, fluoride content, microbial load and thermal/packaging stability as per Bureau of Indian Standards (BIS) specification IS 6356:2021. The formulation satisfied all evaluated parameters and, being free of added fluoride, is classified as a Type-1 non-fluoridated herbal toothpaste. These findings support the feasibility of an entirely plant-based, dye-free purple toothpaste as a safe alternative to conventional whitening dentifrices, while indicating a need for further clinical validation of its long-term safety and whitening efficacy.

**KEYWORDS:** Herbal toothpaste; Purple toothpaste; Optical colour correction; *Wrightia tinctoria*; *Pongamia pinnata*; *Syzygium cumini*; BIS IS 6356:2021.

## 1. INTRODUCTION

### 1.1 Oral Health

Oral health underpins mastication, speech, facial aesthetics and nutrition, yet conditions such as dental plaque, caries, gingivitis, periodontal disease, tooth discolouration, enamel erosion and halitosis remain widespread because of poor hygiene, unhealthy diets, tobacco use, microbial infection and environmental factors.<sup>[1,18]</sup> Regular brushing with an effective dentifrice remains the principal preventive measure. Conventional toothpastes containing synthetic antimicrobials, detergents, abrasives, preservatives and artificial additives reduce plaque and microbial load effectively, but their prolonged use has been linked to tooth sensitivity, mucosal irritation and altered taste — concerns that have driven growing interest in herbal dentifrices formulated with plant-derived bioactive compounds valued for antimicrobial, anti-inflammatory, antioxidant and wound-healing activity.



Fig. 1: Systemic and local consequences of poor oral health.

### 1.2 The Human Tooth

A tooth is a hard, calcified structure used for biting and chewing. Its outermost layer, enamel, is the hardest substance in the human body and protects the tooth from wear and decay; beneath it lies dentin, a softer bone-like tissue forming the bulk of the tooth; and at the core lies the pulp, a soft, vascularised and innervated tissue that keeps the tooth vital. The root is covered by cementum and anchored to the jawbone by the periodontal ligament, which cushions the force of chewing. Anatomically the tooth is divided into the crown (visible above the gum line) and the root (embedded in the jawbone). Humans develop 20 primary (milk) teeth from about six months of age, later replaced by 32 permanent teeth in the full adult set.

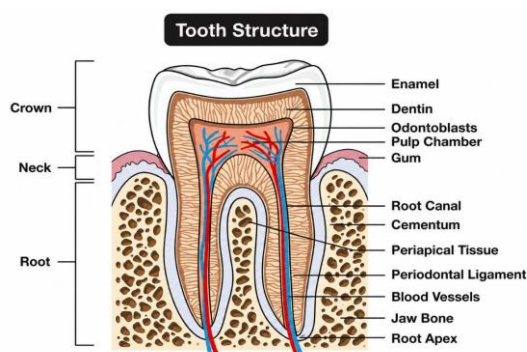


Fig. 2: Structure of the human tooth.

### 1.3 Optical Colour Correction — the “Purple” Principle

Purple toothpaste whitens teeth temporarily by optical colour correction rather than by chemically bleaching the enamel. The principle rests on complementary-colour theory, in which purple/violet sits opposite yellow on the colour wheel.

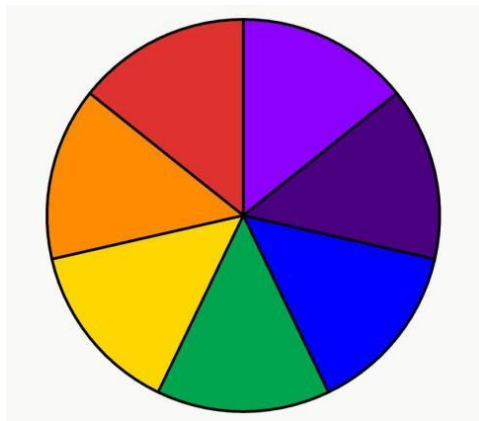


**Fig. 3: Colour wheel showing the yellow – purple complementary relationship.**

When a small amount of violet pigment is deposited and retained on the tooth/pellicle surface after brushing, violet-blue light reflection increases and the perceived yellow tone of the tooth is optically reduced, so the tooth appears cooler, brighter and whiter — without altering the intrinsic colour of the underlying enamel or dentin, and without the equivalence of peroxide bleaching. A natural purple colour, such as that of *Syzygium cumini*, does not automatically confer the same optical-whitening effect as a purpose-selected violet dye; the pigment must possess suitable optical properties and must be retained sufficiently on the tooth surface for the effect to be perceptible.

### 1.4 Functions of the Teeth

- Mastication: incisors cut and slice, canines tear, and premolars/molars crush and grind food, initiating digestion before it reaches the stomach.
- Speech: the position of the tongue against the teeth, particularly the incisors, is essential for sounds such as ‘th’, ‘f’, ‘v’ and ‘s’.
- Facial aesthetics: teeth support the lips and cheeks, preventing a sunken appearance and contributing to the smile.
- Jaw-bone support: chewing pressure stimulates and maintains alveolar bone density; bone can resorb once teeth are lost.
- Digestive protection: proper mechanical breakdown of food reduces strain on the stomach/intestines and the risk of choking.

### 1.5 Anatomy of the Tooth

The crown is the enamel-covered portion exposed above the gingival margin; the cervical line marks its boundary with the root, which is embedded in the alveolar bone. Enamel is composed chiefly of hydroxyapatite arranged in rod-like structures; it is acellular, non-vital and incapable of regeneration once mature. Dentin, harder than bone but softer than enamel, is roughly 70% mineral, 20% organic material and 10% water, and has considerable tensile strength. Cementum covers the root and provides attachment for the periodontal ligament, which in turn anchors the cementum

to the alveolar bone. At the core, the pulp — housed in the pulp chamber and root canal — contains blood vessels, nerves, odontoblasts and fibroblasts, giving the tooth its neurosensory and reparative capacity.

### 1.6 Dental Problems and Corresponding Herbal Therapies

Table 1 summarises common dental problems and the traditional herbal remedies reported against them.<sup>[2]</sup>

**Table 1: Dental conditions and reported herbal therapies.**

| Condition     | Reported herbal therapy                                                                  |
|---------------|------------------------------------------------------------------------------------------|
| Dental caries | Wrightia tinctoria (toothache); Miswak inhibits growth of <i>S. mutans</i>               |
| Gingivitis    | Syzygium cumini mouthwash after periodontal therapy; Neem reduces gum inflammation       |
| Periodontitis | Pongamia pinnata reduces plaque; Syzygium cumini mouthwash lowers inflammation           |
| Oral ulcers   | Wrightia tinctoria applied to decayed teeth; Pongamia pinnata roots used for gums/ulcers |
| Toothache     | Clove oil for anaesthetic pain relief                                                    |

## 2. LITERATURE REVIEW

Devika et al. (2021) reported that acetone, ethyl-acetate and chloroform leaf extracts of *Wrightia tinctoria* showed notable antifungal activity against *Candida* species isolated from the oral cavity by the disc-diffusion method, supporting its use as a natural antifungal in oral-care formulations.

Pulipati et al. (2016) found that ethanolic extract of *Pongamia pinnata* stems inhibited *Staphylococcus aureus* (26.0 mm), *Enterococcus faecalis* (25.66 mm) and *Candida albicans* (28.0 mm) by agar-well diffusion, with an MIC range of 31.2–62.5 mg/mL, supporting relevance to caries prevention.

Bodiba et al. (2018) compared *Azadirachta indica*, *Pongamia pinnata*, *Psidium guajava* and *Mangifera indica* chewing-stick plants and confirmed meaningful antibacterial and gene-expression-altering activity of *Pongamia pinnata* against *Streptococcus mutans*, the principal cariogenic organism.

Sajid et al. (2012) showed that bark, leaf and seed extracts of *Pongamia pinnata* are rich in phenolic compounds that contribute to notable antioxidant and antimicrobial activity.

Tahir et al. (2012) reported that 0.4% *Syzygium cumini* leaf extract exhibited good antibacterial efficacy against *Streptococcus mutans*.

Das, Yavagal and Reddy (2021) found that acetone extract of *Syzygium cumini* seeds showed the most potent activity against periodontal pathogens, with the lowest MIC (6.25 µL/mL) recorded against *Porphyromonas gingivalis*.

Sharma et al. (2016) demonstrated clinically that a jamun-extract mouthwash meaningfully reduced plaque accumulation.

Das et al. (2018) identified flavonoids, alkaloids, saponins, tannins, steroids, terpenoids and resins in *Syzygium cumini* seed extract by GC-MS, with antimicrobial activity across 20–100% test concentrations.

Pandey et al. (2025) confirmed strong antioxidant, xanthine-oxidase-inhibitory and antibacterial activity of *Syzygium cumini* seed extract, supporting its dual role as antioxidant and antimicrobial agent suitable for herbal toothpaste.

### 3. AIM AND OBJECTIVES

The aim of this work is to formulate a purple toothpaste in which the purple colour is generated entirely from herbal sources — without any artificial dye — to achieve optical colour correction from yellow to white/bright teeth, and to evaluate the formulation as per BIS specifications.<sup>[18]</sup>

- Formulate a herbal purple toothpaste using *Wrightia tinctoria*, *Pongamia pinnata* and *Syzygium cumini* as key active ingredients to achieve optical colour correction of teeth.
- Use *Syzygium cumini* fruit extract as a natural source of the purple colour.
- Evaluate the antimicrobial activity of the three plant extracts against oral pathogens implicated in dental caries and gingivitis.
- Evaluate the physicochemical properties (pH, viscosity, foaming ability, spreadability) of the formulated toothpaste.
- Assess the safety, stability and antioxidant potential of the herbal toothpaste.

### 4. PLANT PROFILE

Table 2 lists the plant- and lipid-derived ingredients used in the formulation, their category and traditional use.<sup>[3]</sup>

**Table 2: Plant profile of the formulation.**

| Ingredient                                    | Category / traditional use                                             |
|-----------------------------------------------|------------------------------------------------------------------------|
| Veppalai leaves ( <i>Wrightia tinctoria</i> ) | Herbal drug (leaf); traditionally used in Ayurveda and Siddha medicine |
| Punga seeds ( <i>Pongamia pinnata</i> )       | Medicinal plant/herbal drug; nitrogen-fixing leguminous tree           |
| Jamun ( <i>Syzygium cumini</i> )              | Fruit-bearing tree used in Ayurveda, Siddha and Unani medicine         |
| Coconut oil ( <i>Cocos nucifera</i> )         | Used mainly as the pigment carrier for the purple toothpaste           |

#### 4.1 *Wrightia tinctoria*.<sup>[4]</sup>

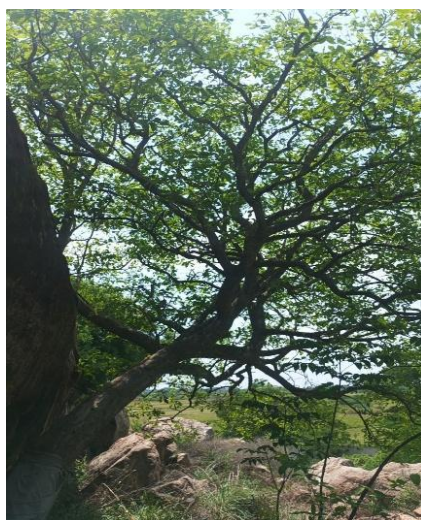


**Fig. 4: *Wrightia tinctoria* (Veppalai).**

Family Apocynaceae; Tamil name Vetpalai. Traditionally used in Ayurveda, Siddha and Unani medicine. Reported medicinal uses include toothache relief via an analgesic leaf extract, antiplaque action through antimicrobial phytoconstituents, anti-gingivitis activity via anti-inflammatory compounds, and an astringent action that helps control minor gum bleeding. Its phytoconstituents show antibacterial and antifungal activity against oral and skin pathogens, and its triterpenoids/alkaloids show anti-inflammatory activity.

#### 4.2 *Pongamia pinnata*.<sup>[5]</sup>



**Fig. 5: *Pongamia pinnata* (Punga) seeds.**

Family Fabaceae; Tamil name Pungai. Bark and twig extracts are chewed or applied for toothache and gum pain; flavonoids and tannins give anti-inflammatory action on gingivitis and an astringent effect that tightens gum tissue and reduces bleeding; the chewed twig is traditionally used to reduce halitosis. Root/twig extract is also used in herbal toothpaste formulations and chew-sticks to clean teeth, reduce plaque and prevent gum disease.

#### 4.3 *Syzygium cumini*



**Fig. 6: *Syzygium cumini* (Jamun).**

Family Myrtaceae; Tamil name Naval pazham. Bark decoction is used as a gargle for oral ulcers and sore throat; bark and leaf extracts inhibit bacteria responsible for plaque and oral infection; twigs are traditionally used as a natural tooth cleaner. Jamun bark/leaf extract is incorporated into toothpaste and mouthwash formulations for its astringent, antimicrobial and gum-strengthening properties, and provided the natural violet-purple pigment used in this formulation.

#### 4.4 Cocos nucifera (Coconut) Oil



Fig. 7: Cocos nucifera (coconut) oil.

Lauric acid in coconut oil is converted in vivo to monolaurin, which is active against *Streptococcus mutans* and other cariogenic/plaque-forming organisms; the oil is traditionally used for oil pulling to reduce plaque, gingivitis and oral malodour, for soothing minor oral wounds/ulcers, and its medium-chain fatty acids (lauric and capric acid) inhibit *Candida albicans*. In this formulation coconut oil served mainly as the carrier for the *Wrightia tinctoria* extract and as the pigment-carrying vehicle for the purple colour.

#### 5. EXCIPIENTS PROFILE

Table 3 lists the pharmaceutical excipients used together with the herbal actives, and their functional category.<sup>[7]</sup>

Table 3: Excipients used in the formulation and their function.

| Excipient              | Category / function                                                       |
|------------------------|---------------------------------------------------------------------------|
| Dicalcium phosphate    | Mild abrasive agent — helps polish the teeth                              |
| Sodium lauryl sulphate | Surfactant and foaming agent                                              |
| Sodium saccharine      | Artificial sweetener — masks bitter herbal flavour, improves palatability |
| Gum tragacanth         | Natural binder and thickening agent                                       |
| Calcium carbonate      | Abrasive and polishing agent                                              |
| Purified water         | Solvent and liquid vehicle                                                |

#### 6. MATERIALS AND METHODS

##### 6.1 Preparation of Plant Extracts<sup>[8]</sup>

*Wrightia tinctoria* (coconut-oil extract): fresh, mature leaves were washed with purified water, shade-dried, ground to a coarse powder and macerated in coconut oil to extract the active phytochemicals; the macerate was filtered and gently concentrated to a viscous liquid and stored in an airtight, light-resistant container.

*Pongamia pinnata* powder: mature bark, seed or leaf was washed, chopped and shade-dried below 30°C until moisture content fell below 10%, then coarsely crushed, milled and passed through 80/100-mesh sieves to a uniform particle size suitable for the toothpaste base, and stored airtight in a cool, dark place.

*Syzygium cumini* extract: fresh, mature fruit or seed kernel was washed, de-seeded/crushed and macerated in purified water or ethanol for several hours to extract tannins and flavonoids; the macerate was filtered and the filtrate concentrated under reduced pressure or gentle heat to a viscous extract used for both its herbal activity and as the natural purple pigment source.

## 6.2 Formulation — Quantities Used (per 30 g batch).<sup>[10]</sup>

Table 4: Quantitative composition of the purple herbal toothpaste.

| Ingredient                               | Quantity         |
|------------------------------------------|------------------|
| Wrightia tinctoria (coconut-oil extract) | 4.5 mL (4.020 g) |
| Pongamia pinnata oil                     | 1.5 g            |
| Jamun (Syzygium cumini) extract          | 7.5 mL (4.45 g)  |
| Dicalcium phosphate                      | 4.5 g            |
| Sodium lauryl sulphate                   | 2.415 g          |
| Sodium saccharine                        | 0.030 g          |
| Gum tragacanth                           | 1.47 g           |
| Calcium carbonate                        | 4 g              |
| Purified water                           | 4.5 mL (4.470 g) |
| Activated charcoal                       | 0.075 g          |
| Total                                    | 30 g             |

## 6.3 Phytochemical Confirmatory Tests.<sup>[12]</sup>

Wrightia tinctoria contains the alkaloid tryptanthrin, confirmed by Dragendorff's test: addition of Dragendorff's reagent to the acidic extract produced an orange-red precipitate, confirming the presence of alkaloids.

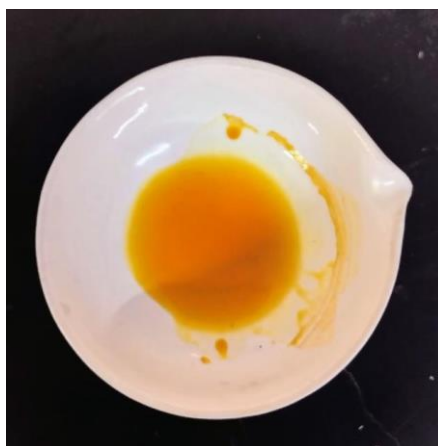


Fig. 9: Dragendorff's test — alkaloids (Wrightia tinctoria).

Pongamia pinnata contains the flavonoid karanjin, confirmed by Shinoda's test: magnesium turnings added to the ethanolic extract followed by dropwise concentrated HCl produced a pink-to-red colour, confirming the presence of flavonoids.

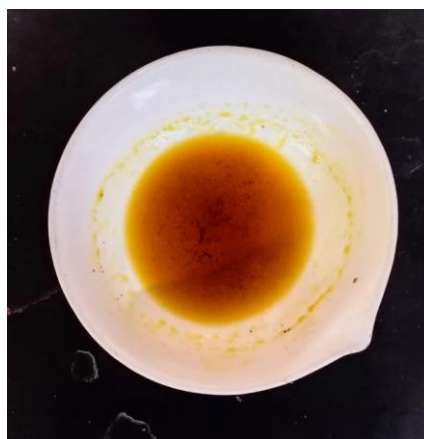


Fig. 10: Shinoda's test — flavonoids (Pongamia pinnata).

*Syzygium cumini* contains tannins (gallic acid), confirmed by the ferric chloride test: a few drops of 5% ferric chloride added to the extract produced a blue-to-black colour, confirming the presence of tannins.



**Fig. 11: Ferric chloride test — tannins (*Syzygium cumini*).**

#### 6.4 Evaluation of the Formulated Toothpaste

**Fineness:** the sample was fully dispersed in water, ultrasonicated for ~10 min to break up aggregates, washed through a 150- $\mu$ m IS sieve, and the material retained was dried and weighed to give fineness as % retained.

**pH:** 10 g of toothpaste was suspended in 10 mL of freshly boiled, cooled distilled water (27°C) to give a 50% aqueous suspension, and pH was measured within 5 minutes on a calibrated pH meter.



**Fig. 12: pH determination of the formulated toothpaste.**

**Heavy metals:** the ashed/digested sample was dissolved in dilute acetic acid, treated with hydrogen sulfide/thioacetamide, and the resulting sulfide colour was compared against a standard lead solution using Nessler cylinders.

**Arsenic:** tested by the standard Gutzeit apparatus — ash-solution, ferric ammonium sulphate and stannous chloride were combined to generate arsine gas, and the stain on mercuric bromide paper was compared with a 0.001 mg arsenic-trioxide standard stain.

Foaming index: a weighed quantity of paste was dispersed in a fixed volume of water in a 100 mL stoppered cylinder, shaken for a fixed number of strokes, and initial foam volume and the volume remaining after 3–5 minutes were recorded to give % foam retained.

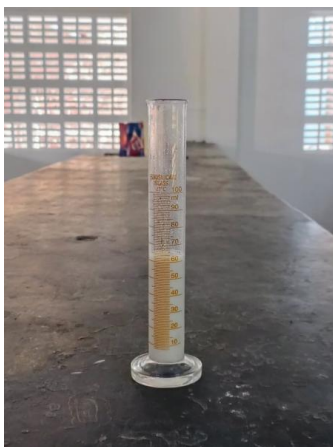


**Fig. 13a: Graduated cylinder without foam.**



**Fig. 13b: Graduated cylinder with foam generated.**

Fluoride ion test: the sample slurry in deionised water was centrifuged/filtered, mixed with an equal volume of TISAB solution, and read on a fluoride ion-selective electrode calibrated against standards; a light-pink colour on the qualitative check indicated the result reported.



**Fig. 14: Fluoride ion test — sample vs. reagent blank, confirming absence of fluoride.**

Microbial count: the sample was aseptically dispersed, serially diluted and plated by pour-/spread-plate technique; total viable count was read as CFU/g. Per BIS, TVC must not exceed 1000 CFU/g with complete absence of Gram-negative pathogens.



**Fig. 15: Absence of *E. coli* (Gram-negative) growth on the culture plate.**

Extrusion test: the tube was stabilised at  $27 \pm 2^\circ\text{C}$  and manually pressed; the paste had to emerge as a smooth, continuous mass without splitting the seams and evacuate smoothly on rolling from the crimped end.

Abrasivity: a butter-paper surface was examined visually and by touch for scratches or grit marks after contact with the paste — a scratched/torn paper indicates abrasive particles, while a smooth, unmarked paper indicates a low-abrasive, well-formulated paste.

Thermal stability: full, unopened tubes were held at  $45 \pm 2^\circ\text{C}$  for 28 days and inspected for curdling, phase separation or oil bleeding, then cooled to  $5^\circ\text{C}$  for 1 hour and pressed to confirm the product remained readily extrudable.

Packaging test: filled tubes were held at  $45 \pm 2^\circ\text{C}$  for 10 days; the tube was then slit open and the internal epoxy liner inspected under adequate light for corrosion, pitting, chemical attack or discolouration.



**Fig. 16: Packaging-compatibility test on the filled tube.**

## 7. RESULTS AND DISCUSSION

All evaluated parameters of the formulated purple herbal toothpaste were found to be within the limits specified by BIS IS 6356:2021 for dentifrices, as summarised in Table 5.

**Table 5: Summary of evaluation parameters for the formulated purple herbal toothpaste (BIS IS 6356:2021).**

| S.No | Evaluation parameter | Observation                                                | Report                      |
|------|----------------------|------------------------------------------------------------|-----------------------------|
| 1    | Abrasivity           | $\geq 250$                                                 | Within limit                |
| 2    | pH                   | 7.59                                                       | Within limit                |
| 3    | Heavy metals         | Lead 8.00 ppm; Arsenic 0.50 ppm; Mercury 0.02 ppm          | Within limit                |
| 4    | Fluoride ion         | Nil                                                        | Absent                      |
| 5    | Foaming index        | 50                                                         | Pass                        |
| 6    | Fineness             | No hard/sharp particles                                    | Pass                        |
| 7    | Packaging test       | No corrosion / discolouration                              | Pass                        |
| 8    | Microbial count      | 900 CFU/g                                                  | Within limit (< 1000 CFU/g) |
| 9    | Thermal stability    | Heat: no separation/oil bleeding; Cold: readily extrudable | Within limit                |
| 10   | Extrusion test       | Smooth, continuous evacuation on rolling                   | Pass                        |
| 11   | Arsenic (Gutzeit)    | Complies                                                   | Pass                        |

The formulation showed a pH of 7.59, within the near-neutral range recommended for oral-care products and unlikely to irritate oral mucosa or erode enamel. Abrasivity and fineness results indicated a smooth, low-abrasive paste free of hard or sharp particles, consistent with the intended use of dicalcium phosphate and calcium carbonate as mild polishing agents rather than harsh abrasives. The foaming index of 50 reflects an acceptable, moderate lathering profile from sodium lauryl sulphate, sufficient for effective brushing without excessive foam. Heavy-metal (lead, arsenic, mercury) and arsenic-specific results were within permissible BIS limits, and the fluoride ion test was negative, confirming the formulation as fluoride-free by design. Microbial enumeration (900 CFU/g) remained below the BIS ceiling of 1000 CFU/g with no Gram-negative pathogens detected, indicating microbiological safety. The paste also withstood accelerated thermal cycling ( $45 \pm 2^\circ\text{C}$  for 28 days;  $5^\circ\text{C}$  for 1 hour) without phase separation or oil bleeding and remained readily extrudable, and the packed tubes showed no internal corrosion or discolouration after 10 days at  $45 \pm 2^\circ\text{C}$ , supporting adequate shelf and packaging stability.

**Fig. 17: Teeth before brushing with the purple herbal toothpaste.****Fig. 18: Teeth after brushing with the purple herbal toothpaste, showing the intended optical brightening effect.**

Because the formulation relies on *Syzygium cumini* extract as its sole colourant, its purple-whitening action is expected to be more subtle and less standardised than that achievable with a purpose-selected synthetic violet dye, since natural pigment concentration, hue and substantivity to the enamel pellicle can vary between extraction batches. This remains an important limitation to address before the product could be positioned as a direct, dye-free alternative to commercial purple toothpastes.

## 8. CONCLUSION

A purple herbal toothpaste was successfully formulated using *Wrightia tinctoria*, *Pongamia pinnata* and *Syzygium cumini* extracts as the principal herbal ingredients, with *Syzygium cumini* additionally serving as a natural source of the purple pigment in place of a synthetic dye. The formulation was evaluated for its organoleptic, physicochemical and microbiological properties and was found satisfactory in all respects assessed, in accordance with BIS IS 6356:2021. As the formulation contains no fluoride, it is classified as a Type-1 non-fluoridated herbal toothpaste. A herbal toothpaste of this kind is expected to be non-toxic, safe and well accepted by patients, in line with the long tradition of herbal use in oral hygiene and the generally milder side-effect profile of natural remedies relative to synthetic ingredients. The extract-based formulation was prepared and evaluated successfully; further clinical studies are recommended to establish the long-term safety and whitening efficacy of the purple-colour effect.

## ACKNOWLEDGEMENT

**First And foremost, we wish To Express My Thanks To Almighty God For His Love And Guidance Throughout Our Work.**

Any successful completion of task would be incomplete without mentioning people who made it possible with their guidance and encouragement. We give our lovable thanks to our **PARENTS** for providing us the place where we are standing successfully now.

We thank **THE TAMILNADU Dr.M.G.R.Medical University, Chennai** for including project work into the curriculum.

We express Our heartfelt thanks to our chairman and correspondent **Prof. K. R. ARUMUGAM, M. Pharm.,** Ultra College of Pharmacy, Madurai-20.

We owe Our sincere thanks to **Dr. A. BABUTHANDAPANI, M.Pharm, Ph. D.,** Principal, Ultra College of Pharmacy, Madurai for allowing us to utilize the facility to carry out this project in this institution.

We express our extreme sense of gratitude, profound thanks to our Vice Principal **Dr. S. RAMKUMAR, M.Pharm, MBA, Ph. D.,** Department of Pharmacognosy, Ultra College of Pharmacy, Madurai for the support he rendered throughout this project work.

We extend our gratefulness to **Dr. S. ARJUN, M.Pharm., Ph.D.,** Assistant Professor, Department of Pharmaceutics, Ultra College of Pharmacy for his extraordinary ideas and earnest effort in guiding us throughout the project work in each and every stage.

We sincerely thank **MR.G. PRATHESH, M.Pharm,** librarian **Mr. THIRUNAVUKARASU, M. A., Lit., M.Phil.,** and **Mrs. VASANTHI, M.L.I.S.E., R. VISHNU PRIYA(B.Pharm),, M. HEMA PRIYADHARSHINI (B.Pharm), T.L. ABDUL RAHMAN THANGAL(B.Pharm),, A. NIVETHAN(B.Pharm),, E. DHAYANITHI(B.Pharm),, M.**

**FARHATH SHABURA., MUTHU HARI PRAKASH(D.Pharm)** for providing needful help in collecting journals and book reference. We immensely thank **Mrs. P. UMA DEVI.,** Lab Assistant, **Mrs. J. VIJAYALAKSHMI.,** Lab Attender for providing needed help for the completion of the work.

We thanks to our beloved friends.

## 9. REFERENCES

1. Fong CD, et al. Dental Tissue Compartments — enamel, dentin, cementum, pulp, periodontium. J Dent Educ, 2005; 69(5): 555-570.
2. Kumar A, et al. Herbal remedies for oral and dental health: a comprehensive review of their multifaceted mechanisms including antimicrobial, anti-inflammatory, and antioxidant pathways. PMC (National Library of Medicine), 2025.
3. Sangeetha S, Hari A, Pattam S, Nihal P, Athira A. An Updated Review on *Wrightia tinctoria* (Roxb.) R. Br. J Pharm Res Int, 2021; 33(56A): 234-244.
4. Jeyam M, et al. Phytochemical and pharmacological assessment of *Wrightia tinctoria* R. Br.: A review. World J Pharm Res.
5. Sowjanya P, Srinivasa Babu P, Lakshmi DN, et al. A phyto pharmacological review on a versatile medicinal plant: *Pongamia pinnata* (L.) Pierre. J Pharmacogn Phytochem, 2018; 7(4): 459-463.
6. Dixit A, Jain AK, Tiwari P, Gupta N, Gangele P. A Phytopharmacological Review on an Important Medicinal Plant — *Wrightia tinctoria*. Curr Res Pharm Sci, 2014; 4(3): 70-76.
7. Narayanasamy AS, Vijaya R, Rajalakshmi R, et al. Study on formulation of polyherbal toothpaste using natural ingredients. IJPS Journal.
8. Wadher K, Dabre S, Gaidhane A, Trivedi S, Umekar M. Evaluation of antipsoriatic activity of gel containing *Pongamia pinnata* extract on Imiquimod-induced psoriasis. Clin Phytosci, 2021; 7(1): 1-6.
9. Sadeghi-Nejad B, Moghimipour E, Naanaie SY, Nezarat S. Antifungal and antibacterial activities of polyherbal toothpaste against oral pathogens, in vitro. Jundishapur J Nat Pharm Prod.
10. Jagtap AM, Kavlage SR, Kanse SS, Sholke VW, Gavade AS, Vambhurkar GB, Tadkar RR, Dange VN, et al. Preparation and Evaluation of Toothpaste. Asian J Pharm Res/Sci.
11. Vaishnavi W, et al. Formulation and Evaluation of Safe and Effective Herbal Toothpaste for Oral Hygiene. Int J Pharm Sci (IJPS), 2022 /2026.
12. Maheshwaran, et al. Phytochemical Testing Methodologies and Principles for Preliminary Screening/Qualitative Testing. Asian Plant Res J., 2024; 12(5): 11-38.
13. Srivastava R, et al. A review on phytochemical, pharmacological, and pharmacognostical profile of *Wrightia tinctoria*: Adulterant of *kurchi*. Pharmacogn Rev, 2014; 8(15): 36-44.
14. Pulipati S, et al. Antimicrobial efficacy of *Pongamia pinnata* (L) Pierre against dental caries pathogens of clinical origin. Int Ayurvedic Pharma Res, 2016; 3(5): 546-551.
15. Das A, et al. Antibacterial Efficacy of *E. Jambolana* (*Syzygium cumini*) Seeds Extracts against Periodontal Pathogens: An In-Vitro Study. Int J Ayurveda Pharma Res, 2021; 9(10): 16-20.
16. More RN, Hingmire PM, Jadhav DM. Primary phytochemical and pharmacognostic studies on *Syzygium cumini* Linn. (*Jambhul*). J Pharmacogn Phytochem, 2024; 13(1): 299-305.

17. Alkharfy KM, Gilani AH, Rasul G, Shabir G, Anwar F, Sajid ZI. Antioxidant, Antimicrobial Properties and Phenolics of Different Solvent Extracts from Bark, Leaves and Seeds of *Pongamia pinnata* (L.) Pierre. *Molecules*, 2012; 17(4): 3917-3932.
18. Mohamed Shamel, et al. Influence of different types of whitening toothpastes on the tooth colour, enamel surface roughness and enamel morphology of human teeth.
19. The Jamun Journey: Exploring Microscopical, Phytochemical and Pharmacological Profile of *Syzygium cumini*. *IJPS Journal*.
20. Studies on Formulation of Herbal Toothpaste from *Pongamia* Seeds and Its Medicinal Evaluation. *Int J Pharm Sci (IJPS) Journal*.