

International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



Development and Assessment of a Natural Teeth Whitening Powder Using Herbal Ingredients

Mr. Prashant S. Raut¹, Prof. Mr. Ankush R. Dudhe², Mr. Vijay K. Rathod³,

Mr. Om V. Kurkule⁴, Mr. Bhushan S. Warghat⁵ Students of B. Pharm Final Year^{1,3,4,5} Assistant Professor, Department of Pharmaceutical Chemistry² Ishwar Deshmukh Institute of Pharmacy, Digras, Maharashtra, India

Abstract: The increasing demand for natural oral care products has led to the development of alternative formulations for teeth whitening that are safe, effective, and free from synthetic chemicals. This study focuses on the formulation and evaluation of a herbal-based teeth whitening powder using ingredients such as activated charcoal, neem powder, clove powder, baking soda, calcium carbonate, and peppermint oil. The formulation was assessed for its physicochemical properties, whitening efficacy, antimicrobial activity, and user acceptability. Whitening performance was evaluated using shade guides on stained teeth samples, while antimicrobial tests were conducted against Streptococcus mutans and Lactobacillus species using the disc diffusion method. The formulated powder demonstrated a notable whitening effect within 7–14 days of use and exhibited moderate antibacterial activity. pH analysis and abrasiveness tests confirmed its safety for enamel. The product was found to be stable over three months and was well accepted by volunteers, with minimal reported side effects. These findings support the potential of herbal ingredients in developing a safe and effective teeth whitening powder suitable for routine oral care.

Keywords: Herbal teeth whitening, natural oral care, activated charcoal, neem, clove, baking soda, antimicrobial activity, tooth discoloration, enamel safety, dental aesthetics, teeth whitening powder, herbal formulation

I. INTRODUCTION

Oral hygiene is an essential aspect of overall health and well-being. Among various dental concerns, tooth discoloration is a common aesthetic issue that affects individuals' confidence and social interactions. The global rise in demand for whiter teeth has led to the widespread use of chemical-based whitening products, many of which contain hydrogen peroxide or carbamide peroxide. While effective, these agents can lead to adverse effects such as tooth sensitivity, enamel erosion, and gum irritation with prolonged use.

In recent years, there has been growing interest in natural and herbal alternatives for oral care due to their safety profile, minimal side effects, and environmental friendliness. Traditional herbs such as neem (*Azadirachta indica*), clove (*Syzygium aromaticum*), and peppermint (*Mentha piperita*) have long been used

in Ayurvedic and folk medicine for their antimicrobial, anti-inflammatory, and refreshing properties. Additionally, baking soda and activated charcoal have gained popularity as mild abrasives and detoxifying agents, aiding in the removal of extrinsic stains from teeth surfaces.

This research focuses on the development and evaluation of a teeth whitening powder that combines these natural ingredients to provide an effective, safe, and affordable solution for tooth discoloration. The study investigates the powder's physicochemical properties, whitening efficacy, antimicrobial activity, and user acceptability. By offering a natural alternative to conventional whitening agents, this formulation aims to promote both dental aesthetics and long-term oral health.

Copyright to IJARSCT www.ijarsct.co.in



DOI: 10.48175/IJARSCT-25633





International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



Objectives:

- To formulate a natural teeth whitening powder using herbal and mineral-based ingredients with known oral care benefits.
- To evaluate the physicochemical properties of the formulated powder, including texture, pH, and stability.
- To assess the whitening efficacy of the formulation on stained teeth samples using visual shade guides.
- To determine the antimicrobial activity of the powder against common oral pathogens such as *Streptococcus mutans* and *Lactobacillus* species.
- To evaluate the safety and abrasiveness of the formulation to ensure it is non-damaging to tooth enamel.
- To analyze user acceptability and satisfaction through feedback collected during a short-term usage trial.

II. MATERIAL AND EQUIPMENT

2.1.Material:

2.1.1.Neem Powder:

- Synonyms: Holy tree, Margosa
- Biological Source: It is obtained from fully matured seeds of Azadirachta indica Linn.
- Family: Meliaceae.
- Chemical Constituents: Neem is rich in limonoids, tannins, flavonoids, and essential oils, but its unique therapeutic power largely comes from a class of compounds known as tetranortriterpenoids.

Uses:

- Skin diseases: Eczema, psoriasis, acne, boils (used in pastes or baths).
- Antimicrobial: Fights bacterial and fungal infections.
- Immune booster: Chewing fresh leaves or drinking neem tea boosts immunity.
- Diabetes management: Regulates blood sugar levels.
- Mouth ulcers and gum infections: Chewing leaves helps with oral health.



Figure1: Neem Powder

2.1.2.Clove Powder:

- Synonyms: Caryophyllum, Clove flower, Clove buds.
- **Biological Source:** Colve consists of dried flower buds Of Eugenia caryophyllus. It should contain not less than 7.0 per cent (w/w) Of eugenol calculated on dried basis.
- Family: Myrtaceae
- Chemical Constituents: Clove contains about 15 to 20 percent of volatile Oil, 10 percent to 13 percent oftannin (gallotannic acid), resin, chromone and eugenin. The volatile oil of the drug contains eugenol (about 70 to 90 percent).

Copyright to IJARSCT www.ijarsct.co.in



DOI: 10.48175/IJARSCT-25633





International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



Uses:

- Dental Care: Toothache relief, antiseptic mouthwash, gum infection treatment
- Digestive Health: Carminative (relieves gas), stimulates digestion, relieves nausea
- Respiratory Issues: Treats coughs, asthma, bronchitis; expectorant
- Pain Relief: Topical analgesic for sore muscles, joints, and headaches
- Anti-inflammatory: Reduces inflammation in artis, injuries



Figure 2:Clove Powder

2.1.3.Peppermint Oil:

- Synonym: Mentha piperita oil, Peppermint essential oil
- Family: Lamiaceae (Mint family)
- **Biological Source:** Obtained from the fresh leaves and flowering tops of *Mentha piperita* L., a hybrid mint (a cross between *Mentha aquatica* and *Mentha spicata*).
- Chemical Constituents: Menthol (30–50%) primary active compound, Menthone, Menthyl acetate, 1,8-Cineole, Isomenthone, Limonene, Carvone (in small amounts)

Uses:

- Carminative (relieves gas)
- Antispasmodic (used in IBS)
- Analgesic (mild pain reliever)
- Decongestant (used in inhalants for cold/flu)
- Antimicrobial



Figure 3:Peppermint Oil

Copyright to IJARSCT www.ijarsct.co.in



DOI: 10.48175/IJARSCT-25633







International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



Table	1: Ra	ole Of	Ingredie	nt

Table 1. Role Of Ingredient				
Sr. No	Ingredient	Role Of Ingredient		
1	Neem Powder	Antibacterial agent		
2	Clove Powder	Antimicrobial, flavor		
3	Peppermint Oil	Flavoring, mild antiseptic		
4	Activated Charcoal	Adsorption of stains, detoxifying agent		
5	Baking Soda	Mild abrasive, pH balancing		
6	Calcium Carbonate	Mild abrasive, polishing agent		

2.2. Equipment:

Table 2: List Of Equipment Sr. No **List Of Equipment** 1 Analytical balance Mortar and pestle or blender 2 3 Sieve (60 mesh) 4 Airtight containers 5 Spatula and weighing boats 6 Gloves and masks for hygiene

III. FORMULA Table 3: Formulation Of The Powder

Sr.No	Ingredient	Quantity(50gm)		
1	Neem Powder	5gm		
2	Clove Powder	5gm		
3	Peppermint Oil	3-4 Drops		
4	Activated Charcoal	10gm		
5	Baking Soda	12.5gm		
6	Calcium Carbonate	15gm		

IV. FORMULATION

Weighing the Ingredients

Accurately weigh each ingredient using an analytical balance according to the predetermined formulation ratio.

Pulverization and Sieving

All powdered ingredients are finely ground (if needed) and passed through a 60-mesh sieve to ensure uniform particle size and smooth texture.

Blending

Using the geometric dilution method, mix all dry powders thoroughly in a mortar and pestle or blender to achieve a homogeneous blend.

DOI: 10.48175/IJARSCT-25633

Addition of Peppermint Oil

Gradually add peppermint oil drop by drop while mixing to ensure even distribution and avoid clumping.

Final Mixing

Mix the entire batch for 10–15 minutes to ensure even blending of all ingredients.

Copyright to IJARSCT www.ijarsct.co.in









International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal





Packaging

Transfer the final formulation into clean, dry, and airtight containers. Label the containers with batch number and storage conditions.

Storage

Store in a cool, dry place away from direct sunlight and moisture.

V. EVALUATION OF THE FORMULATED TEETH WHITENING POWDER

5.1 Organoleptic Evaluation

- Appearance: Observed for color, texture, and uniformity.
- Odor: Assessed for pleasantness and freshness (due to peppermint oil).
- Taste: Checked by a small group of volunteers (without swallowing).

5.2 Physicochemical Evaluation

Test	Method
pH Determination	5% w/v aqueous solution measured using a digital pH meter
Moisture Content	Oven-drying method at 105°C
Flow Property	Assessed using angle of repose method
Bulk and Tapped Density	Used to calculate Carr's index and Hausner ratio

5.3 Particle Size Distribution

Sieving method to ensure uniformity and proper texture for brushing.

5.4 Whitening Efficacy

- Test Model: Extracted bovine or human teeth stained with coffee/tea.
- Procedure: Teeth were brushed with the powder twice daily for 7–14 days.
- Assessment: Tooth shade measured before and after using a Vita shade guide or spectrophotometer.
- Result Expression: Change in tooth shade unit (Δ Shade).

5.5 Abrasiveness Test

Measured using the Relative Dentin Abrasivity (RDA) value.

RDA values below 250 are considered safe. Test performed by comparing enamel loss on test samples vs. standard abrasive.

5.6 Antimicrobial Activity

- Microorganisms Tested: Streptococcus mutans, Lactobacillus acidophilus
- Method: Agar disc diffusion
- Zone of Inhibition: Measured in mm to determine antibacterial efficacy

5.7 Stability Study

- Stored at room temperature for 3 months.
- Evaluated monthly for changes in color, odor, texture, and pH.



DOI: 10.48175/IJARSCT-25633





International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



VI. RESULTS SUMMARY

1. Whitening Efficacy:

- The powder demonstrated a notable whitening effect within 7–14 days of use on stained teeth (using tea/coffee stains).
- Whitening was assessed using a Vita shade guide or spectrophotometer, with results reported as Shade (change in tooth shade unit).

2. Antimicrobial Activity:

- Showed moderate antibacterial effects against Streptococcus mutans and Lactobacillus acidophilus.
- Measured by zone of inhibition using the agar disc diffusion method.

3. Physicochemical Properties:

- pH was within a safe range for oral use (measured using a 5% w/v solution).
- Moisture content was assessed by oven drying.
- Powder showed good flow properties and uniform particle size (via angle of repose and sieving).
- Carr's index and Hausner ratio confirmed good compressibility and flowability.

4. Abrasiveness:

- Measured using Relative Dentin Abrasivity (RDA).
- RDA value was below 250, indicating it is safe for enamel.

5. Stability:

- Powder remained physically and chemically stable for 3 months under room conditions.
- No significant change in color, odor, texture, or pH over the storage period.

6. User Acceptability:

• Volunteers found the powder to be pleasant in taste and smell (thanks to peppermint oil). It was well tolerated, with minimal reported side effects during the usage trial.

VII. CONCLUSION

The formulated herbal teeth whitening powder, composed of neem powder, clove powder, activated charcoal, baking soda, calcium carbonate, and peppermint oil, proved to be an effective and safe alternative to conventional chemicalbased whitening agents. The formulation exhibited a significant whitening effect within 7–14 days of use and demonstrated moderate antimicrobial activity against common oral pathogens such as Streptococcus mutans and Lactobacillus acidophilus. Physicochemical evaluations confirmed the product's stability, favorable flow properties, and enamel-safe abrasiveness. Additionally, the formulation was well accepted by users, with a pleasant taste and minimal side effects reported. These findings highlight the potential of natural ingredients in the development of oral care products that are both effective and consumer-friendly. Further long-term studies and clinical trials may strengthen the case for its commercial application in the dental care market.

REFERENCES

- [1]. Bajaj, S., & Tandon, S. (2011). The effect of various toothpastes on the plaque and gingiva of school children. Journal of Indian Society of Pedodontics and Preventive Dentistry, 29(2), 102–107.
- [2]. Prashant, G. M., Chandu, G. N., Murulikrishna, K. S., & Shafiulla, M. D. (2007). The effect of mango and neem extract on four organisms causing dental caries: Streptococcus mutans, Streptococcus salivarius, Streptococcus mitis, and Streptococcus sanguis: An in vitro study. Indian Journal of Dental Research, 18(4), 148–151.

Copyright to IJARSCT www.ijarsct.co.in



DOI: 10.48175/IJARSCT-25633





International Journal of Advanced Research in Science, Communication and Technology

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 10, April 2025



- [3]. Park, M., Bae, J., & Lee, D. S. (2007). Antibacterial activity of [10]-gingerol and [12]-gingerol isolated from ginger rhizome against periodontal bacteria. Phytotherapy Research, 22(11), 1446–1449.
- [4]. Akinmoladun, F. O., & Akinrinlola, B. L. (2016). Antimicrobial activity of clove oil against oral pathogens. Journal of Oral Health and Dental Management, 15(3), 107–111.
- [5]. Greenwell, M. & Rahman, P. K. S. M. (2015). Medicinal plants: Their use in anticancer treatment. International Journal of Pharmaceutical Sciences and Research, 6(10), 4103–4112.
- [6]. American Dental Association. (2019). Tooth Whitening/Bleaching: Treatment Considerations for Dentists and Their Patients. Retrieved from: <u>https://www.ada.org</u>
- [7]. Abou Neel, E. A., Aljabo, A., Strange, A., Ibrahim, S., Coathup, M., Young, A. M., ... &Bozec, L. (2016). Demineralization-remineralization dynamics in teeth and bone. International Journal of Nanomedicine, 11, 4743–4763.
- [8]. Sharma, A., & Arora, R. (2018). Herbal toothpastes: An overview. International Journal of Pharmaceutical Sciences and Research, 9(6), 2300–2308.
- [9]. Chandrappa, H., & Dhananjaya, S. (2016). A comparative evaluation of antimicrobial efficacy of herbal and conventional dentifrices against Streptococcus mutans and Lactobacillus acidophilus: An in vitro study. Journal of International Society of Preventive and Community Dentistry, 6(6), 484–489.
- [10]. Hiremath, S. S. (2011). Textbook of Preventive and Community Dentistry. Elsevier Health Sciences.
- [11]. Mehta, R., & Panchal, S. (2013). Evaluation of antimicrobial activity of various toothpastes and mouth rinses: An in vitro study. Journal of Indian Association of Public Health Dentistry, 11(1), 37–42.
- [12]. Balappanavar, A. Y., Sardana, V., & Singh, M. (2013). Herbal and fluoride toothpaste: Which is better in reducing plaque and gingival inflammation? Journal of Indian Association of Public Health Dentistry, 11(3), 211–215.
- [13]. Almas, K. (2002). The antimicrobial effects of extracts of Azadirachta indica (Neem) and Salvadora persica (Arak) chewing sticks. Indian Journal of Dental Research, 13(1), 23–26.
- [14]. Shubha, G., & Jha, S. K. (2017). A review on herbal toothpaste: An alternative to chemical toothpaste. World Journal of Pharmaceutical and Life Sciences, 3(5), 449–455.
- [15]. Bhattacharjee, A., & Bhattacharjee, C. (2017). Activated charcoal as a natural teeth whitener: Myth or reality? International Journal of Pharmaceutical Sciences and Research, 8(10), 4255–4260.
- [16]. Hossain, M. S., Kabir, M. H., & Begum, M. (2014). Antimicrobial activity of peppermint (Mentha piperita) leaf extract. International Journal of Research in Pharmaceutical and Biosciences, 4(1), 1–9.
- [17]. Al-Dabbagh, S. A. A. (2014). The effectiveness of baking soda toothpaste on plaque removal. Journal of Baghdad College of Dentistry, 26(1), 137–140.
- [18]. Manipal, S., Hussain, G., & Ramesh, T. (2016). Comparative evaluation of the efficacy of a herbal dentifrice and a conventional dentifrice on plaque and gingivitis: A clinical trial. Journal of Ayurveda and Integrative Medicine, 7(3), 151–157.



DOI: 10.48175/IJARSCT-25633

