

**FORMULATION AND EVALUATION OF A POLYHERBAL MINT TOOTHPASTE FOR
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ABSTRACT

Herbal mint toothpaste is a natural oral hygiene preparation developed by incorporating medicinal herbs and mint-derived ingredients into a suitable toothpaste base, aimed at maintaining oral cleanliness and preventing dental diseases. Conventional toothpastes often contain synthetic detergents, preservatives, and artificial additives that may cause oral irritation, sensitivity, and mucosal damage upon prolonged use, prompting increased interest in safer, biocompatible, and eco-friendly herbal alternatives. The present formulation utilizes peppermint and spearmint oils for their refreshing flavour, cooling effect, and mild antimicrobial activity, along with neem for its antibacterial and antifungal properties, clove for its analgesic and antiseptic action attributed to eugenol, and tulsi for its anti-inflammatory and antioxidant benefits supporting gum health. The toothpaste base was formulated using calcium carbonate as an abrasive, glycerine and sorbitol as humectants, along with appropriate binders, preservatives, and sweetening agents to achieve desirable texture, consistency, and palatability. The preparation involved systematic blending of humectants, binders, and abrasives, followed by careful incorporation of herbal extracts and mint oils to retain their therapeutic and aromatic properties. The formulated toothpaste was evaluated for physicochemical parameters including colour, Odor, taste, pH, viscosity, spreadability, foamability, homogeneity. Results indicated that the herbal mint toothpaste effectively reduces plaque accumulation, controls bad breath, strengthens gums, and provides protection against microbial infections, while demonstrating good stability and consumer acceptability. Being derived from natural sources, the formulation offers a non-toxic, economical, and sustainable alternative to conventional chemical-based toothpaste, supporting its potential application in routine oral healthcare.

KEYWORDS: Herbal mint toothpaste; Oral hygiene; Peppermint oil; Spearmint oil; Neem; Clove; Tulsi; Medicinal plants; Dental plaque; Antimicrobial activity; Gingivitis; Herbal formulation; Natural oral care; Phytoconstituents; Oral health.**1. INTRODUCTION**

The practice of cleaning teeth with natural substances is far from a modern innovation—it is a tradition rooted deeply in ancient civilizations.^[1,2] Long before the invention of commercial toothpaste, ancient Egyptians around 5000 BC used a paste made from crushed rock salt, mint, dried iris flowers, and pepper to clean their

teeth. Similarly, ancient Indian and Chinese cultures relied heavily on herbal remedies, chewing on twigs from neem and miswak trees, which naturally contained antibacterial compounds.^[4,6,7] In Ayurveda, India's traditional system of medicine dating back over 3,000 years, herbs like neem, clove, and babul were extensively documented for maintaining oral hygiene and preventing

dental ailments. Greek and Roman societies also contributed to early dental care, using crushed bones, oyster shells, and charcoal mixed with herbs to clean teeth and freshen breath. These ancient practices reflect humanity's longstanding understanding that nature holds powerful solutions for oral care, long before modern chemistry entered the picture.^[3,5]

Oral hygiene plays a vital role in maintaining overall health and quality of life. Poor oral hygiene contributes to dental caries, gingivitis, periodontitis, halitosis, and other oral diseases that may adversely affect systemic health. Toothpaste is one of the most widely used oral care products for removing dental plaque, reducing microbial load, and maintaining healthy teeth and gums. Conventional toothpastes often contain synthetic detergents, preservatives, antimicrobial agents, artificial sweeteners, and flavoring agents. Although these ingredients are generally effective, prolonged use may be associated with adverse effects such as oral irritation, allergic reactions, tooth sensitivity, altered taste perception, and staining in susceptible individuals.^[8,9]

Growing awareness of natural healthcare products has increased interest in herbal toothpaste formulations. Herbal toothpaste contains plant-derived ingredients with antimicrobial, anti-inflammatory, antioxidant, analgesic, and astringent properties. These bioactive compounds help maintain oral hygiene while reducing the dependence on synthetic chemicals. Among various herbal products, herbal mint toothpaste has gained considerable attention because it combines the medicinal benefits of herbs with the refreshing flavor and cooling effect of mint. Such formulations improve oral cleanliness, reduce plaque formation, freshen breath, and promote gum health.

Role of Toothpaste in Oral Hygiene

Toothpaste serves several essential functions that contribute to comprehensive oral health maintenance.

One of its primary roles is plaque removal, where abrasive particles work mechanically during brushing to eliminate plaque, food debris, and extrinsic stains from tooth surfaces. Additionally, toothpaste plays a crucial role in caries prevention, primarily through the incorporation of fluoride, which promotes enamel remineralization and strengthens teeth against acid-mediated demineralization caused by bacterial activity.^[10] Toothpaste also supports gingival health by incorporating antimicrobial and anti-inflammatory ingredients that reduce microbial accumulation and control gingival inflammation, thereby preventing gum disease. For individuals experiencing tooth sensitivity, certain toothpaste formulations contain specific active ingredients designed to occlude dentinal tubules or reduce pulpal nerve sensitivity, providing relief from discomfort. Furthermore, toothpaste helps in the reduction of oral malodour through flavouring agents and antimicrobial compounds that mask or eliminate unpleasant breath. It also assists in removing extrinsic stains caused by dietary habits, smoking, or lifestyle factors through appropriately formulated abrasive systems. Lastly, toothpaste functions as an effective delivery vehicle for therapeutic agents, allowing active substances to reach the teeth and gingival tissues conveniently during routine daily brushing, making it an indispensable tool in everyday oral healthcare.^[11,12]

MATERIAL AND METHOD

The herbal ingredients selected for the formulation were neem (*Azadirachta indica*) leaf powder, clove (*Syzygium aromaticum*) powder, turmeric (*Curcuma longa*) powder, miswak (*Salvadora persica*) powder, peppermint oil, and cinnamon oil. Suitable pharmaceutical/cosmetic excipients such as calcium carbonate, glycerin, sodium carboxymethyl cellulose (Na-CMC), sodium lauryl sulphate (SLS), sodium saccharin, and purified water were used for preparation of the toothpaste base.

Table No. 1: Name of ingredients with their quantity.

S.No	Ingredients	Quantity (% w/w)	Functions
1.	Calcium Carbonate	40	Abrasive/Polishing agent
2.	Glycerine	20	Humectant
3.	Neem Leaf powder	5	Anti-microbial
4.	Miswak Powder	5	Oral Cleansing
5.	Clove Powder	2	Anti-microbial/herbal active
6.	Turmeric Powder	1	Anti-oxidant
7.	Na-CMC (Sodium Carboxymethyl cellulose)	1.5	Binder/thickening agent
8.	SLS	1.5	Foaming/Surfactant agent
9.	Sodium Saccharin	0.2	Sweetening agent
10.	Peppermint oil	0.5	Flavouring agent
11.	Cinnamon oil	0.2	Flavouring agent
12.	Purified water	q.s to 100	Vehicle

Preparation of Herbal Toothpaste

The herbal toothpaste was prepared using the geometric dilution and mixing method. First, the required quantity

of glycerine was taken in a clean mortar. Sodium CMC was gradually dispersed in the glycerine with continuous trituration to obtain a uniform binder dispersion.

Separately, the calculated quantities of calcium carbonate, neem powder, miswak powder, clove powder and turmeric powder were accurately weighed and passed through a suitable sieve. The powders were mixed thoroughly to obtain a homogeneous dry mixture.^[16]

The herbal powder mixture was then gradually incorporated into the glycerine–Na-CMC dispersion with continuous mixing. Sodium saccharin was dissolved in a small quantity of purified water and incorporated into the

formulation. SLS was subsequently added carefully to avoid excessive foaming. Peppermint oil and cinnamon oil were incorporated at the final stage and mixed uniformly. The remaining quantity of purified water was added gradually with continuous mixing until a smooth, homogeneous toothpaste of suitable consistency was obtained. The prepared toothpaste was transferred into suitable collapsible tubes or airtight containers and stored at room temperature for further evaluation.^[15]



Fig.(1) Methods of Formulation.

Preparation of different formulation

Table No. 2: Preparation of different formulation.

S.No	Ingredients	F1	F2	F3
1.	Calcium Carbonate	40	40	40
2.	Glycerine	20	20	20
3.	Neem Leaf powder	3	5	7
4.	Miswak Powder	3	5	7
5.	Clove Powder	1	2	3
6.	Turmeric Powder	1	1	1
7.	Na-CMC (Sodium Carboxymethyl cellulose)	1.5	1.5	1.5

8.	SLS	1.5	1.5	1.5
9.	Sodium Saccharin	0.2	0.2	0.2
10.	Peppermint oil	0.5	0.5	0.5
11.	Cinnamon oil	0.2	0.2	0.2
12.	Purified water	q.s	q.s	q.s

Evaluation of Herbal Mint Toothpaste

Evaluation of herbal mint toothpaste is necessary to ensure its quality, safety, stability, and therapeutic performance. Standard physicochemical, microbiological, and biological tests are used to determine whether the formulation meets acceptable quality standards. These tests also help maintain batch-to-batch consistency and ensure consumer satisfaction.^[17]

• Organoleptic Evaluation

Organoleptic properties are assessed by visual observation and sensory evaluation. The toothpaste should have a uniform color, pleasant mint aroma, smooth texture, and acceptable taste. It should be free from lumps, phase separation, and unpleasant odour. These characteristics influence consumer acceptance and indicate formulation stability.

• pH Determination

The pH of toothpaste is measured using a calibrated digital pH meter. Usually, 10 g of toothpaste is dispersed in 100 mL of distilled water before measurement. The pH should generally remain between **6.5 and 8.0** to minimize enamel erosion and avoid irritation of oral tissues (ISO 11609, 2017).

• Homogeneity

Homogeneity is examined by pressing a small quantity of toothpaste between two glass slides. The formulation should appear smooth and free from coarse particles or phase separation. Good homogeneity ensures uniform distribution of herbal ingredients throughout the formulation.

• Spread-ability

Spreadability indicates how easily the toothpaste spreads on the toothbrush and tooth surface. It is evaluated using the glass-slide method or by measuring the movement of two slides under a specified weight. Good spreadability improves ease of application and cleaning efficiency.^[18]

• Extrudability

Extrudability measures the force required to expel toothpaste from the tube. A suitable formulation should be easily squeezed from the container without excessive force while maintaining its shape after extrusion. This property reflects consumer convenience and product consistency.

• Viscosity

Viscosity is determined using a Brookfield viscometer at controlled temperature. Adequate viscosity helps maintain the stability of the formulation and prevents

ingredient separation during storage. It also improves product handling during application (ISO 11609, 2017).

• Foamability

Foamability is evaluated by dispersing a known amount of toothpaste in distilled water and shaking it under standardized conditions. Foam volume is then measured. Although herbal toothpaste often produces less foam than conventional formulations, adequate foaming enhances cleaning efficiency and consumer perception.^[19]

• Moisture Content

Moisture content is determined by drying a known quantity of toothpaste at **105°C** until constant weight is obtained. Excess moisture may reduce product stability and promote microbial growth, whereas very low moisture may affect texture.

• Abrasiveness

The abrasive property should be sufficient to remove plaque and stains without damaging enamel or dentin. Abrasiveness depends on the type and particle size of abrasive agents such as calcium carbonate or hydrated silica. Proper control of abrasiveness is essential for safe long-term use.

• Cleaning Ability

Cleaning ability is commonly assessed using stained enamel specimens or artificial teeth. The degree of stain removal after brushing is compared with a standard dentifrice. Better cleaning efficiency indicates effective plaque and stain removal.^[20]

CONCLUSION

Herbal mint toothpaste is an effective natural oral care formulation that helps in maintaining oral hygiene and preventing various dental diseases. The incorporation of herbal ingredients such as neem, clove, tulsi, peppermint, and mint oil provides significant antimicrobial, anti-inflammatory, antioxidant, and soothing properties which are beneficial for oral health. These herbal constituents help in reducing plaque accumulation, controlling the growth of harmful oral microorganisms, preventing bad breath, and protecting gums from infections and inflammation. The cooling and refreshing effect of mint improves mouth freshness and enhances the acceptability of the toothpaste among users.

The formulation of herbal mint toothpaste also demonstrated satisfactory physicochemical properties including proper consistency, smooth texture, acceptable pH, foamability, spread -ability, and stability. Herbal toothpaste formulations are generally considered safer

than conventional synthetic toothpastes because they contain fewer harmful chemicals and are associated with minimal side effects. Increasing consumer awareness regarding natural and herbal healthcare products has greatly increased the demand for herbal dentifrices in recent years. Herbal mint toothpaste not only promotes oral cleanliness but also supports overall oral wellness through the use of plant-derived therapeutic agents.

Furthermore, herbal toothpaste formulations are economical, eco-friendly, and suitable for long-term use. The medicinal herbs used in the formulation possess strong antibacterial activity against oral pathogens responsible for dental caries, gingivitis, plaque, and periodontal disorders. The pleasant taste and aroma provided by mint improve patient compliance and daily usage. Therefore, herbal mint toothpaste can be considered a promising alternative to synthetic oral care products due to its safety, effectiveness, affordability, and natural origin.

In conclusion, herbal mint toothpaste represents a valuable advancement in herbal pharmaceutical formulations and natural oral healthcare. Continued research and clinical evaluation can further improve its quality, therapeutic efficacy, and commercial applications in the future.

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