



Research Paper

Formulation and Evaluation of Polyherbal Toothpaste for Oral Care

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ABSTRACT

Herbal toothpaste has gained considerable importance due to increasing awareness regarding the adverse effects associated with synthetic oral care products. The present study aimed to formulate and evaluate a herbal toothpaste containing Myristica fragrans (Nutmeg) extract as a natural antimicrobial and anti-inflammatory agent for oral hygiene maintenance. The nutmeg extract was prepared by Soxhlet extraction using ethanol as a solvent. The formulated toothpaste was evaluated for various physicochemical parameters including color, odor, texture, pH, spreadability, foamability, abrasiveness, homogeneity, and stability. The prepared formulation exhibited satisfactory organoleptic characteristics, suitable pH for oral application, good spreadability, adequate foaming property, and mild abrasiveness without causing enamel damage. The herbal toothpaste demonstrated acceptable consistency and stability during the evaluation period. The antimicrobial constituents present in Myristica fragrans may contribute to the prevention of dental caries, plaque formation, and gingivitis. The study concludes that the formulated herbal toothpaste can serve as a safe and effective alternative to conventional synthetic toothpaste formulations

INTRODUCTION

Toothpaste is a semi-solid dentifrice preparation used with a toothbrush for maintaining oral hygiene. It helps in cleaning teeth, preventing plaque formation, reducing bad breath, and protecting teeth from dental caries and gum diseases. Modern toothpaste formulations contain abrasives, humectants, surfactants, preservatives,

flavoring agents, and therapeutic ingredients such as fluoride or herbal extracts.[1]-[3]

Herbal toothpaste formulations have become increasingly popular because they contain natural ingredients with fewer side effects compared to synthetic chemicals. Medicinal plants used in oral care products possess antimicrobial, anti-inflammatory, antioxidant, and healing properties that help maintain oral health. Herbal ingredients such as clove, neem, aloe vera, pomegranate, and

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nutmeg are commonly incorporated into toothpaste formulations due to their beneficial pharmacological actions.[4]-[6]

Myristica fragrans Houtt., commonly known as Nutmeg, belongs to the family Myristicaceae. Nutmeg contains important phytoconstituents including myristicin, elemicin, safrole, terpenes, alpha-pinene, beta-pinene, and macelignan. These compounds exhibit antimicrobial, antifungal,

antioxidant, anti-inflammatory, and analgesic activities. In oral care applications, nutmeg helps reduce oral microbial growth, plaque formation, and gum inflammation.

The present research work focuses on the formulation and evaluation of herbal toothpaste containing *Myristica fragrans* extract for improving oral hygiene and maintaining dental health.[6]-[7]



Figure: 01. *Myristica fragrans* Houtt.

2. MATERIALS AND METHODS

2.1 Collection and Authentication of Plant Material

Fresh and dried fruits of *Myristica fragrans* (Nutmeg) were procured from the local market of Mandleshwar, Madhya Pradesh, India. The collected plant material was washed to remove impurities and dried under shade at room temperature for several days to avoid degradation of active constituents. The dried fruits were powdered using a mechanical grinder and stored in airtight containers for further studies. [8,10]

2.2 Preparation of Nutmeg Extract

The ethanolic extract of *Myristica fragrans* was prepared by Soxhlet extraction method. About 80 g of powdered nutmeg was packed in a thimble and placed inside the Soxhlet apparatus. Ethanol (1300 ml) was used as extraction solvent because of its excellent ability to dissolve phytoconstituents such as essential oils, terpenoids, and phenolic

compounds. The extraction was carried out at 60°C for approximately 65 hours until complete extraction was achieved. The obtained extract was concentrated by evaporating excess solvent and stored in a desiccator for further use in toothpaste formulation. [7,11]

Soxhlet Extraction Method

1. The powdered drug was filled into a cellulose thimble.
2. Ethanol was poured into the round-bottom flask.
3. Heating mantle was used to boil the solvent.
4. Solvent vapors condensed and passed through the powder repeatedly.
5. Continuous extraction occurred due to siphoning action.
6. The extract was collected and concentrated.

2.3 Formulation of Herbal Toothpaste

The herbal toothpaste was prepared by conventional semisolid mixing method. Initially,



the binding agent was dispersed uniformly in water to form a smooth mucilage. Preservatives and other soluble ingredients were dissolved separately. The powdered ingredients such as nutmeg powder and titanium dioxide were sieved and mixed thoroughly to ensure uniformity. The powder mixture was slowly incorporated into the

mucilage with continuous stirring to obtain a homogeneous paste. Sodium lauryl sulphate and menthol were added at the final stage to avoid excessive foaming during mixing. The prepared toothpaste was packed in suitable airtight containers. [12,13]

Table 1: Ingredients Used in Herbal Toothpaste Formulation

S. No.	Ingredients	Role
1	Nutmeg Powder	Antibacterial and abrasive agent
2	Methyl Paraben	Preservative
3	Menthol	Cooling and flavoring agent
4	Titanium Dioxide	Whitening agent
5	Sodium Lauryl Sulphate	Foaming agent
6	Water	Vehicle

Table 2: Formula of Herbal Toothpaste

Ingredients	Quantity
Nutmeg Powder	10 g
Methyl Paraben	0.5 g
Menthol	0.3 g
Titanium Dioxide	1 g
Sodium Lauryl Sulphate	5 g
Water	15 ml

3. EVALUATION OF HERBAL TOOTHPASTE

3.1 Organoleptic Evaluation

The prepared toothpaste was examined visually for color, odor, texture, appearance, and consistency.

Organoleptic evaluation is important to determine patient acceptability and product elegance. The formulation showed light brown color with pleasant characteristic odor and smooth homogeneous texture. [14]

Table

3: Organoleptic Evaluation

Parameter	Observation
Color	Light Brown
Odor	Pleasant
Texture	Smooth
Appearance	Homogeneous

3.2 pH Determination

The pH of toothpaste was determined using a calibrated digital pH meter. About 1 g of toothpaste was dispersed in 10 ml distilled water and allowed to stand for 10 minutes. The electrode of the pH meter was immersed into the dispersion and reading was recorded. The pH was found to be

6.8 ± 0.2 , indicating suitability for oral cavity without causing irritation. [15]

3.3 Spreadability Test

Spreadability determines the ease of application of toothpaste on toothbrush surface. The test was carried out by placing a small amount of toothpaste



between two glass slides and applying weight over them. The time required for movement of slides was noted. Good spreadability indicates smooth application and better patient compliance. [12]

Formula

$$S = \frac{M \times L}{T}$$

Where:

- S = Spreadability
- M = Weight tied to upper slide
- L = Length moved by slide
- T = Time taken

Observation

The prepared toothpaste showed good spreadability.

3.4 Foamability Test

Foamability was evaluated by dispersing 1 g toothpaste in 10 ml distilled water in a measuring cylinder followed by vigorous shaking for one minute. The volume of foam produced was measured. Adequate foam formation indicates effective cleansing property due to surfactants. [16]

3.5 Abrasiveness Test

Abrasiveness is an important parameter to ensure effective cleaning without damaging enamel. A small amount of toothpaste was rubbed on butter paper and observed for scratches. The formulation exhibited mild abrasiveness indicating safety for enamel surface. [19]

3.6 Homogeneity Test

The toothpaste formulation was visually inspected for homogeneity by pressing a small quantity

between thumb and index finger. The absence of lumps and phase separation confirmed good homogeneity and smooth consistency. [20]

3.7 Stability Study

The prepared formulation was stored at room temperature for 30 days and evaluated periodically for color, odor, texture, pH, and phase separation. No significant changes were observed during the storage period indicating good stability of the formulation. [20]

4. RESULTS AND DISCUSSION

The herbal toothpaste formulated using *Myristica fragrans* extract exhibited satisfactory physicochemical properties. The formulation possessed pleasant odor, smooth consistency, and acceptable appearance. The pH of formulation was found near neutral range which is suitable for oral use. Good spreadability and adequate foamability indicated better applicability and cleansing action. The mild abrasive nature of nutmeg powder helped in cleaning teeth without damaging enamel. The antimicrobial phytoconstituents present in nutmeg such as myristicin and macelignan may contribute to reduction of oral microbial load and prevention of plaque formation. The stability study confirmed that the prepared toothpaste remained stable without any phase separation or degradation. Therefore, the herbal toothpaste formulation can be considered effective and safe for maintaining oral hygiene. [11,14,17]

5. GRAPHICAL REPRESENTATION OF RESULTS

Table 4: Evaluation Parameters of Herbal Toothpaste

Evaluation Parameter	Result
pH	6.8
Spreadability	Good
Foamability	Good
Abrasiveness	Mild
Homogeneity	Excellent
Stability	Stable



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