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"Formulation And Evaluation Of Ayurvedic Herbal Toothpaste"

Swamin Zinge1,Krushit Patel 2,Mrs nilam Nile 3

CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY,SCHOOL OF PHARMACY, NAVI MUMBAI,PANVEL

ABSCTRAT

Plant derived preparations have been essential components for maintenance of oral hygiene and the treatment of oral diseases globally since ancient times.

Objectives: To study the efficacy of an Ayurvedic toothpaste containing these herbs.

This project focuses on the formulation and development of an herbal toothpaste using Ayurvedic ingredients known for their natural oral health benefits. The primary aim is to create a chemical-free, eco-friendly, and effective alternative to commercial toothpastes by incorporating traditional herbs such as neem (Azadirachta indica), clove (Syzygium aromaticum) licorice (Glycyrrhiza glabra). These ingredients have been chosen for their proven antimicrobial, anti-inflammatory, and breath-freshening properties. The formulation process involved extracting active components from each herb and optimizing their concentrations to ensure both efficacy and safety. The final product was evaluated for parameters such as pH, abrasiveness, taste, texture, and microbial activity. Results indicated that the Ayurvedic toothpaste offers comparable, if not superior, performance to conventional toothpastes, with the added advantage of being free from synthetic additives. This study highlights the potential of traditional knowledge systems in modern oral care applications.

INRODUCTION

Toothpaste is a paste or gel dentifrice used with a toothbrush to clean and maintain the aesthetics and health of teeth. Toothpaste is used to promote oral hygiene: it is an abrasive that aids in removing dental plaque and food from the teeth, assists in suppressing halitosis, and delivers active ingredients (most commonly fluoride) to help prevent tooth decay (dental caries) and gum disease (gingivitis).[1] Owing to differences in composition and fluoride content, not all toothpastes are equally effective in maintaining oral health. The decline of tooth decay during the 20th century has been attributed to the introduction and regular use of fluoride-containing toothpastes worldwide.[2][3] Large amounts of swallowed toothpaste can be

poisonous.[4] Common colors for toothpaste include white (sometimes with colored stripes or green tint) and blue.

THERAPEUTIC HERBAL INGREDIENTS IN TOOTHPASTE

NEEM:

BIOLOGICAL NAME: Azadirachta indica

KINGDOM: Plantae

ORDER: Sapindales

FAMILY: Meliaceae

SUBFAMILY: Melioideae

GENUS: Azadirachta

Neem, scientifically known as Azadirachta indica, is a tree native to the Indian subcontinent and has been revered for its medicinal properties for centuries. Every part of the Neem tree – from its bark, leaves, seeds, to its oil – boasts a myriad of therapeutic benefits. In traditional Ayurvedic medicine, Neem is hailed as a 'sarva roga nivarini,' meaning 'the curer of all ailments.' Its potent antibacterial, antifungal, and anti-inflammatory properties make it a versatile remedy for various health issues, including dental care.

key benefits of using Neem toothpaste:

- Antibacterial Action: Neem's potent antibacterial properties help combat harmful bacteria in the mouth, reducing plaque buildup and lowering the risk of cavities and gum disease. You can also pair your neem toothpaste with other healthy habits to prevent cavities.
- Anti-inflammatory Benefits: Neem toothpaste soothes gum inflammation, alleviates discomfort, and promotes gum health, making it an ideal choice for individuals prone to gingivitis or periodontal issues.
- Fresh Breath: Neem's natural deodorising properties effectively neutralise bad breath, leaving your mouth feeling clean and refreshed throughout the day.
- Gentle Yet Effective: Unlike harsh chemical-laden toothpaste formulations, Neem toothpaste offers a gentle yet effective solution for maintaining oral health, making it suitable for individuals with sensitive teeth or gums.

CLOVE OIL:

BIOLOGICAL NAME: syzygium aromaticum

KINGDOM: plantae

ORDER: myrtales

FAMILY: myrtaceae

SUBFAMILY: myrtoideae

GENUS: syzygium

SPECIES: aromaticum

Oil of clove, also known as **clove oil** or **eugenol**, is an essential oil extracted from the clove plant, *Syzygium aromaticum*. Clove oil is commonly used in aromatherapy and for flavoring food, tea, and toothpaste. In alternative medicine, it may be used as a topical medication to relieve toothache. There is insufficient medical evidence to support its use as an analgesic for treating pain.

- Helps to prevent cavities: A study in the International Journal of Dentistry concluded that clove essential oil has the power to decrease tooth decalcification—in this case, caused by apple juice. Researchers discovered that it's even capable of remineralizing teeth, a significant finding that proves clove oil is a perfect complement to fluoride for preventing cavities.
- Reduces dental discomfort: Have you ever heard of people using clove oil to numb their gums when experiencing toothache? This is because cloves have analgesic properties. In one Journal of Dentistry study, cloves were found to be just as effective as benzocaine when used as a topical anesthetic for dental woes. Research suggests that cloves can reduce the pain associated with dental visits.
- Keeps bacteria at bay: Published in the Journal of Natural Products, another study showed that cloves stopped the growth of the bacteria that commonly leads to gum disease. Additionally, research published in the Journal of Indian Society of Periodontology found that cloves can have antiplaque and antigingivitis effects when used in mouthwash or oral rinse formulas.

AMLA POWDER:

BIOLOGICAL NAME:

Phyllanthus emblica

KINGDOM: plantae

ORDER: malpighiales

FAMILY: phyllanthaceae

SUBFAMILY: phyllanthoideae

GENUS: Phyllanthus

SPECIES: emblica

The tree is small to medium in size, reaching 1–8 metres (3+½–26 feet) in height. The bark is mottled. The branchlets are finely pubescent (not glabrous), 10–20 centimetres (4–8 inches) long, usually deciduous. The leaves are simple, subsessile and closely set along branchlets, light green, resembling pinnate leaves. The flowers are greenish–yellow. The fruit is nearly spherical, light greenish–yellow, quite smooth and hard on appearance, with six vertical stripes or furrows.

- Several studies prove the efficacy of amla in maintaining oral health.
- It helps keep your mouth clean and fights dental cavities.
- Amla helps keeping gum infections like gingivitis and periodontitis away.
- Excess consumption of amla could lower the pH in the mouth and the acidic nature could erode your teeth over a period of time causing teeth sensitivity.
- Consuming amla in moderation is the key to keeping your gums healthy.
- Amla is known for its high vitamin C content, which acts as a natural antioxidant. This vitamin helps in neutralizing harmful free radicals in the mouth, reducing oxidative stress, and promoting overall oral health.
- Amla or Indian gooseberry is classified among the most potent herbs in Ayurveda which has multiple benefits, especially for teeth and gums. According to the beliefs of Indian mythology, Amla was the first tree to be created in this universe.

- In a clinical study, its efficacy, along with the dried fruit of *Harada*, in preventing dental caries has been found to be comparable to chlorhexidine with a lesser time of action. Amla provides this anti-caries effect by increasing salivary pH and inhibiting the common bacteria responsible for caries

GLYCERIN:

CHEMICAL FORMULA: $C_3H_8O_3$

Glycerin, or glycerol, is a colorless, odorless, sweet-tasting liquid that is hygroscopic, meaning it attracts moisture from the environment. It is derived from natural sources like vegetable oils and animal fats, making it a versatile ingredient in many industries, including pharmaceuticals, food, and cosmetics. In the dental world, glycerin serves several purposes, such as acting as a lubricant, sweetener, and humectant, which helps retain moisture in products.

The Benefits of Glycerin in Dental Products

1. **Moisture Retention**: One of the primary roles of glycerin in dental products is its ability to retain moisture. This property is particularly beneficial in toothpaste and mouthwashes, where it helps maintain a pleasant texture and prevents the product from drying out. For individuals with dry mouth, glycerin can provide a soothing effect, enhancing comfort during oral care routines.
2. **Taste Enhancement**: Glycerin is naturally sweet, which makes it an effective sweetener in many dental products. Its inclusion can improve the taste of toothpaste and mouthwashes, making them more palatable for both children and adults. This can encourage regular use and ultimately contribute to better oral hygiene.
3. **Lubrication**: In dental care, lubrication is essential for a smooth application of products. Glycerin acts as a lubricant, facilitating the spread of toothpaste or mouthwash across the teeth and gums. This can enhance the effectiveness of the product, ensuring that it covers all surfaces adequately.
4. **Stabilization of Formulas**: Glycerin also plays a role in stabilizing dental product formulations. It helps maintain the consistency and integrity of the product, preventing separation and ensuring that active ingredients remain effective. This stability is crucial for the overall performance of dental care products.

XANTHUM GUM:

Xanthan gum is widely used in toothpaste. Xanthan gum does not contain cellulose and it can be applied with other cellulose or colloids. It has a high thickening effect and low dosage. Xanthan gum has excellent shear thinning fluidity, which makes the toothpaste easy to squeeze out and pump out of the tube. The prepared paste is not easy to collapse, the paste is bright, and no fiber-drawing. It has easy hydration and excellent enzyme stability which can produce uniform and stable products. This can improve product stretchability.

- Xanthan gum thickens food and other products, and also prevents ingredients from separating.
- Non-food products, such as oil and cosmetics, also contain xanthan gum.
- Xanthan gum may help lower or stabilize blood sugar.

Xanthan gum serves two primary purposes:

- As a thickening agent: It is added to toothpaste and some other products to keep them uniformly thick. It is also used in industry, for example, helping to thicken drilling oil.

As an emulsifier: Its ability to bind moisture means it can prevent products from separating. For this reason, it is an ingredient in some oil-based salad dressings and cosmetics

Licorice Root:

BIOLOGICAL NAME: glycyrrhiza glabra

KINGDOM: plantae

ORDER: fabales

FAMILY: fabaceae

SUBFAMILY: faboideae

GENUS: gycyrrhiza

SPECIES: glabra

Liquorice (Commonwealth English) or licorice (American English; see spelling differences; IPA: /ˈlɪkərɪʃ, -ɪs/ *LIK-ər-ish, -iss*)[5][6] is the common name of *Glycyrrhiza glabra*, a flowering plant of the bean family Fabaceae, from the root of which a sweet, aromatic flavouring is extracted.[7]

Liquorice is a herbaceous perennial, growing to 1 metre (40 in) in height, with pinnate leaves about 7–15 cm (3–6 in) long, with 9–17 leaflets. The flowers are 8–12 mm ($\frac{5}{16}$–$\frac{1}{2}$ in) long, purple to pale whitish blue, produced in a loose inflorescence. The fruit is an oblong pod, 20–30 mm ($\frac{3}{4}$–$1+\frac{1}{8}$ in) long, containing several seeds.[17] The roots are stoloniferous.[18]

PEPPERMINT OIL:

Peppermint oil has antiseptic and antibacterial properties. Hence, it even works against plaque formation, cleans the teeth efficiently, maintains healthy gums, and even solves bad breath.

All these uses make it an effective and important ingredient in the manufacturing of tooth-paste and mouth-washes as well. It can even provide relief for inflammation and toothache caused by gingivitis.

METHODOLOGY:

1. Collection and Authentication of Raw Materials

All herbal and excipient materials were procured from certified Ayurvedic ingredient suppliers. The primary ingredients included:

•Neem powder (Azadirachta indica) – selected for its strong antibacterial properties.

•Amla powder (Phyllanthus emblica) – rich in vitamin C and antioxidant potential.

•Clove oil (Syzygium aromaticum) – known for its analgesic and antimicrobial activity.

•Licorice root (Glycyrrhiza glabra) – used for its anti-inflammatory and soothing effects.

•Glycerin – used as a humectant and base.

•Xanthan gum – served as a natural thickening agent.

•Coconut oil – used as a carrier oil for extracting fat-soluble phytoconstituents from licorice root.

All materials were visually inspected for quality and stored in airtight containers prior to use.

2. Preparation of Licorice Root Oil (Oil Infusion Method)

•10 grams of dried licorice root were coarsely powdered using a mortar and pestle.

•The powder was soaked in 100 mL of coconut oil and subjected to a gentle oil infusion using the double boiler method.

•The mixture was heated on low flame (below 100°C) for 45–60 minutes with occasional stirring to facilitate the release of active constituents.

•After cooling, the mixture was filtered using muslin cloth and stored in a clean, amber-colored bottle to avoid photodegradation.

3. Formulation of Ayurvedic Herbal Toothpaste

The formulation was developed using the following step-wise procedure:

1.Powder Phase Mixing: Neem powder and amla powder were accurately weighed and mixed thoroughly in a mortar to ensure homogeneity.

2.Binder Phase Preparation: Glycerin was combined with xanthan gum to form a smooth gel base, allowing proper dispersion of powders.

3.Incorporation of Herbal Oil: The prepared licorice-infused coconut oil was slowly added to the gel base with continuous mixing.

4.Addition of Clove Oil: A few drops of clove oil were added for both flavor and its antimicrobial activity.

5.Final Mixing: All components were blended until a uniform, smooth paste was formed.

6.Packaging: The finished formulation was transferred into airtight, labeled containers and stored at room temperature.

Evaluation Parameters

1. pH Determination

•Objective: To ensure the formulation is within the safe range for oral use.

•Method: 1 g of toothpaste was dispersed in 10 mL of distilled water. The pH of the resulting solution was measured using a calibrated digital pH meter.

2. Spreadability Test

•Objective: To assess ease of application and consumer feel.

•Method: A fixed amount of toothpaste was placed between two glass slides and a 500 g weight was applied for 5 minutes. The increase in diameter or area was measured to assess spreadability.

3. Abrasiveness Test

•Objective: To ensure the toothpaste does not damage enamel.

•Method: The toothpaste was gently rubbed onto a clean glass slide using a fingertip. The surface was then examined for any visible scratches or roughness.

4. Stability Study

•Objective: To observe physical stability over time.

•Method: The toothpaste was stored at room temperature (25 ± 2°C) and refrigerated conditions (4–8°C) for 30 days. Parameters such as color, consistency, phase separation, and odor were monitored at intervals

5. Organoleptic Properties

•Objective: To evaluate sensory attributes of the formulation.

•Parameters Observed:

•Color – Natural green hue due to neem content

•Odor – Pleasant, clove-dominated herbal aroma

•Texture/Consistency – Smooth, non-gritty paste

CONCLUSION:

The Ayurvedic toothpaste formulation developed in this study demonstrates the potential of natural ingredients in oral care without relying on synthetic chemicals. By incorporating traditional herbs such as neem, amla, clove oil, and licorice root oil into a base of glycerin and xanthan gum, a stable and visually appealing herbal paste was produced.

The formulation's green coloration, derived from the dominant proportion of neem powder, reflects its high phytoconstituent content and authenticity. Neem and clove are well-documented for their antibacterial and anti-inflammatory properties, while amla adds antioxidant benefits. Coconut oil was intentionally used as a carrier for extracting active compounds from licorice root through a gentle oil infusion method, preserving the root's lipophilic bioactives and enhancing the paste's anti-ulcer and anti-inflammatory potential.

The absence of synthetic surfactants such as Sodium Lauryl Sulfate (SLS) means that the formulation does not produce significant foam—a characteristic consistent with traditional Ayurvedic dental products. This

makes the toothpaste suitable for individuals with sensitive gums, oral ulcers, or those seeking chemical-free alternatives.

Initial evaluation based on organoleptic properties, pH, abrasiveness, spreadability, and stability (observed over 30 days) showed promising results. The paste retained its color, odor, and consistency under both room and refrigerated storage conditions. The absence of phase separation or microbial growth supports its physical stability. Quantitative results from these tests will further validate the formulation upon completion.

Overall, this study supports the development of a natural, effective, and consumer-safe Ayurvedic toothpaste, with potential for commercial application. Further clinical testing and consumer trials are recommended to assess long-term efficacy and market acceptability.