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FORMULATION AND EVALUATION OF POLYHERBAL TOOTHPASTE WITH MARKETED HERBAL TOOTHPASTE

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Abstract:

Herbal toothpaste is gaining popularity due to the use of natural ingredients for maintaining oral hygiene. The present study aimed to formulate and evaluate a polyherbal toothpaste using selected herbal ingredients and assess its properties alongside a marketed herbal toothpaste. The formulation contained Neem, Babul, Guava leaves, Kalmi bark and Camphor, which are traditionally used in oral care. Three formulations (F1, F2 and F3) were prepared by the wet gum method using suitable excipients. The prepared formulations were evaluated for physical appearance, pH, spreadability, foamability, moisture content, abrasiveness, homogeneity and stability. A marketed herbal toothpaste (F4) was also evaluated under similar conditions. The results showed that the prepared formulations had acceptable physical and physicochemical properties. Among them, F1 showed better overall characteristics and was selected as the optimized formulation. Stability studies were carried out for 30 days under room temperature and refrigerated conditions. The formulations showed no significant changes in their physical characteristics during the study period. Thus, the study highlights the potential use of selected herbal ingredients in the preparation of polyherbal toothpaste for oral hygiene.

Keywords: *Polyherbal toothpaste, Herbal ingredients, Neem, Babul, Guava leaves, Formulation, Evaluation, Marketed herbal toothpaste.*

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INTRODUCTION:

Cosmetics comprise a diverse range of products, such as creams, perfumes, lotions, skin cleansing products, and decorative cosmetics. [1] According to the Drug and Cosmetic Act, a "cosmetic" means any article intended to be used by means of rubbing, sprinkling, or spraying on, introduced into, or otherwise applied to any part of the human body for cleansing, beautifying, promoting attractiveness, altering the appearance, and maintaining the health of the skin and hair, provided that the action of the article on the human body is mild. [2]

The word 'cosmetic' is derived from the Greek word "Kosmetikos," which means 'to be able to arrange and decorate.' [3] Cosmetics are primarily intended to maintain or enhance the appearance of the external body surfaces, such as the skin, hair, and teeth, as well as deodorize or perfume them to eliminate odors. Changing the appearance of these surfaces, safeguarding them, and maintaining their integrity or as in the other sense of 'cosmos,' keeping things in good odor, is reflected in the definition of cosmetic. [4]

In modern times cosmetics are considered to be essential commodities of life. Cosmetics not only adorn but also may have psychological effects on users, especially on the skin. They keep the skin supple and help delay the onset of wrinkling. They are also helpful in skin infections and prevention of sunburns. [5]

Cosmetics are general external preparations and are meant to be applied to external parts of the body. In other words, they may be applied to skin, hair, and nails for the purposes of covering, coloring, softening, cleansing, nourishing, waving, setting, modification, preservation, removal and protection. [6]

Among these categories, **oral hygiene cosmetics** play an important role in maintaining the cleanliness and health of the teeth and oral cavity. Toothpaste is one of the most widely used oral hygiene products and forms an essential part of daily dental care. [7]

HISTORY

The history of cosmetics is present for at least 7000 years, and it exists in almost every society around the world. The earliest form of human cosmetic rituals should be body art that includes cosmetics. Cosmetics were not welcome in Rome, but they were used by some aristocratic Romans of the time. It was found that some Romans invented cosmetics in ancient times; for example, Kohl used to cover their eye lining. In 1888, a deodorant intended for cosmetic purposes was discovered by an anonymous American and was marketed with the trade name "Mum."

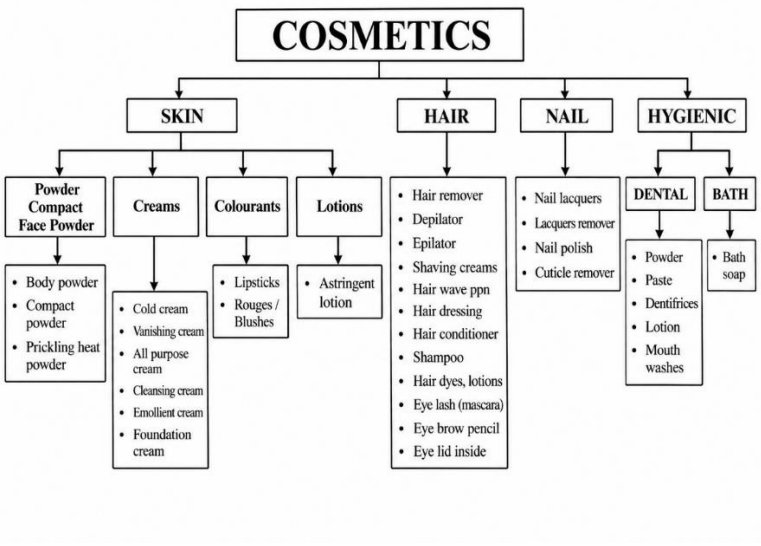
Below Even after 1900 AD, people did not accept cosmetics. Roll-on deodorant and aerosol deodorant were introduced to the market in 1952 and 1965. Russian ballet and colourful makeup were performed around the same time in 1910. It should be noted that the year was started by the current cosmetic manufacturer's production around the beginning of the 20th century. [8]

CLASSIFICATION OF COSMETICS [9]

Cosmetics are classified according to their site of application.

a) Cosmetic for Skin
b) Cosmetic for Hair
c) Cosmetic for Nail
d) Cosm etic for Hygienic

Figure 1: Classification of Cosmetics



Among these categories, oral hygiene cosmetics are widely used for maintaining oral cleanliness and preventing dental diseases. Toothpaste is the most commonly used oral hygiene product because it helps remove dental plaque, freshen breath, and maintain the health of teeth and gums. Due to its daily use and significant role in oral care, toothpaste has become one of the most important cosmetic products for maintaining oral hygiene. [10]

COMMON DENTAL DISEASES

The oral cavity contains both beneficial and harmful bacteria. Poor oral hygiene and plaque accumulation can lead to several dental diseases. Toothpaste plays an important role in preventing these conditions by maintaining oral hygiene.

a) Periodontal (Gum) Disease

Caused by plaque buildup and poor oral hygiene.

b) Tooth Decay and Cavities

Caused by bacteria acting on sugary and acidic food residues.

c) Mouth Ulcers

Painful sores inside the mouth that interfere with eating and speaking

d) Tooth Abscess

A tooth abscess is a pus-filled infection that usually develops due to untreated tooth decay or dental injury. [11]

TOOTHPASTE

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 to help prevent tooth decay and gum disease (gingivitis). [12]

TYPES OF TOOTHPASTE

A. HERBAL TOOTHPASTE:

Herbal toothpaste is a toothpaste where no chemical preservatives are added; instead, glycerin and common salt are added as natural preservatives. This toothpaste can cure various diseases of teeth like gingivitis, tooth decay, cavity, gum bleeding, bad breath and dental-caries as well as it has anti-smoking and anti-cancer properties.

B. MEDICATED TOOTHPASTE:

Medicated toothpaste is a type of toothpaste that applies a medicine to the teeth, gums and mouth. Some medicated toothpastes require specific application techniques or a set duration of contact with the teeth, gums and mouth in order to provide a medical benefit.[13]

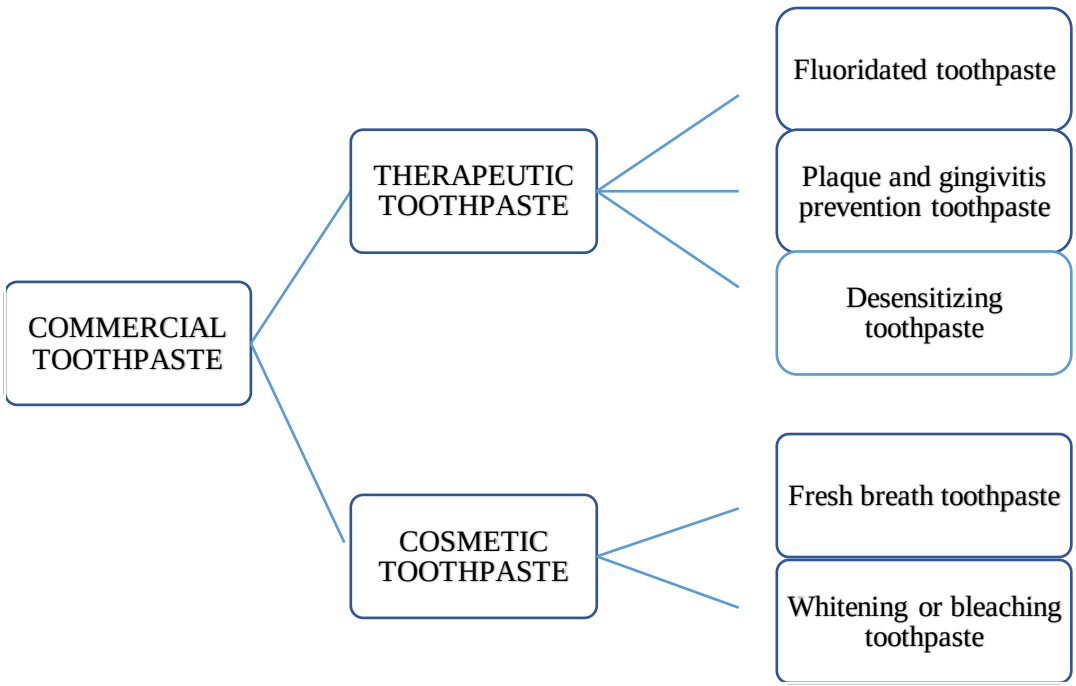


Figure 2: Types of commercial toothpaste

Ideal properties of toothpaste:

- Non-toxic and non-irritant
- Good abrasive effect
- Inexpensive
- Readily available
- Keeps the mouth fresh and clean for a prolonged period.
- Does not cause staining on teeth. [14]

Advantages of toothpaste

- Helps remove dental plaque and food debris from the teeth.
- Prevents dental caries (tooth decay), particularly when fluoride toothpaste is used.
- Strengthens and remineralizes tooth enamel.
- Reduces the growth of harmful oral bacteria.
- Helps prevent gingivitis and maintains healthy gums.
- Freshens breath by reducing odor-causing microorganisms. [15]

Disadvantages of toothpaste

- Foaming agents often cause mouth ulcers.
- Certain chemicals irritate delicate gum tissues.
- Swallowing fluoridated paste causes dental fluorosis.
- Antimicrobials can trigger bacterial antibiotic resistance. [16]

HERBAL COSMETICS

The term 'herbal formulation' refers to a dosage form that contains one or more herbs or processed herbs in specific amounts to provide specific nutritional, cosmetic, and other benefits intended for use in the diagnosis, treatment, or mitigation of diseases in humans or animals, as well as to change the anatomy or physiology of humans or animals.

Historically, various plant materials, such as chewing sticks derived from specific trees or shrubs, were utilized for oral hygiene in societies where modern dental tools were not available. These practices often relied on the natural fibrous texture of the plant or the presence of specific secondary metabolites. [17]

In nowadays, herbal products are subject to ongoing scientific research to evaluate their bioactive components and potential physiological effects. While many people utilize herbal supplements, it is important to note that "natural" does not automatically mean a substance is free of side effects or drug interactions. Organizations like the World Health Organization (WHO) monitor the use of traditional medicine globally, emphasizing the need for quality control, standardized processing, and clinical evidence to ensure safety and efficacy. Individuals considering herbal formulations for health purposes should consult with qualified healthcare professionals to ensure these products are appropriate for their specific health needs and do not interfere with conventional treatment. [18]

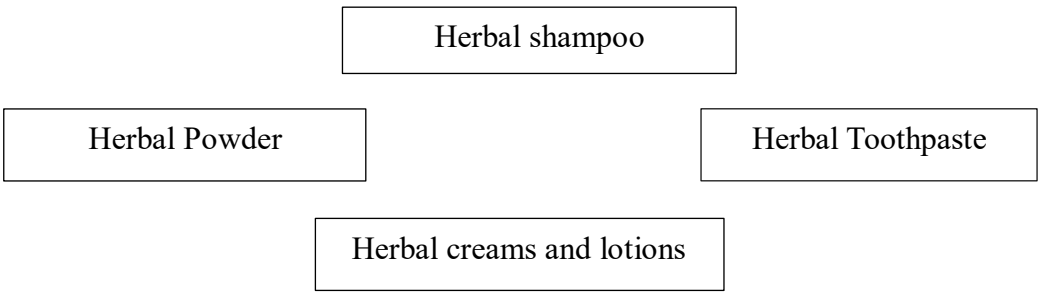


Figure 3: Classification of herbal cosmetics

HERBAL TOOTHPASTE

Herbal toothpaste is a toothpaste where no chemical preservatives are added; instead, glycerin and common salt are added as natural preservatives. This toothpaste can cure various diseases of teeth like gingivitis, tooth decay, cavity, gum bleeding, bad breath and dental-caries as well as it may help maintain oral hygiene and reduce plaque, bad breath, and dental caries due to the presence of bioactive phytochemicals. [19]

Formulation containing natural ingredients is more acceptable in the belief that they are safer than synthetic drugs because it contains fewer synthetic chemicals and is associated with a lower risk of adverse effects.

Herbal toothpaste containing natural ingredients like:

- Guava leaves
- Turmeric
- Clove
- Camphor
- Neem
- Tulsi
- Babul

Which possess antimicrobial, anti-inflammatory, antioxidant, and analgesic properties. Which were traditionally used for tooth cleaning. [20]

Ideal Properties of herbal toothpaste

- Pleasant taste and odor.
- Non-toxic and non-irritant.
- Long-lasting impact.
- Controlled ablativity.
- Good spreadability and foamability.
- Stable during storage and antimicrobial efficacy. [21]

Advantages of herbal toothpaste

- Fights bacteria naturally.
- Uses neem to stop cavities.
- Some herbal ingredients may provide soothing effects.
- Freshens breath.
- Protects enamel. [22]

Disadvantages of herbal toothpaste

- Lack of fluoride.
- Increases risk of dental cavities.
- Slower therapeutic results.
- Variable ingredient quality.
- Short shelf life. [23]

APPLICATIONS OF HERBAL TOOTHPASTE

- **Oral Hygiene:** Helps clean teeth and maintain oral hygiene by removing food particles and plaque.
- **Antibacterial Properties:** Certain herbal ingredients may help control the growth of oral microorganisms.
- **Bad Breath Control:** Helps reduce unpleasant mouth odour and keeps the mouth fresh.
- **Gum Care:** Certain herbal ingredients may help maintain healthy gums.
- **Natural Ingredients:** Contains plant-derived ingredients that provide an alternative approach to daily oral care. [23]

LITERATURE REVIEW

- **Yash Chaudhari *et al.* (2026)** conducted a study on the formulation and evaluation of herbal toothpaste using natural ingredients such as neem stem and bark, babul leaves, guava leaves, kalmi bark, camphor, and honey, along with calcium carbonate, glycerin, sodium lauryl sulfate, and suitable preservatives. The formulated toothpaste was evaluated for various physicochemical parameters including pH, spreadability, foaming ability, abrasiveness, stability, and antimicrobial activity. The results demonstrated that the formulation possessed good physical characteristics, effective against common oral pathogens, and satisfactory stability, indicating its potential as a safe, economical, and effective alternative to conventional chemical-based toothpaste for maintaining oral hygiene.
- **Puja Basule *et al.* (2026)** formulated and evaluated an herbal toothpaste containing Leucas biflora leaf extract along with neem, tulsi, clove oil, and activated charcoal to develop a natural oral care product. The herbal extracts were prepared by Soxhlet extraction and incorporated into four different formulations, which were evaluated for physicochemical parameters including appearance, pH, homogeneity, foamability, spreadability, moisture content, and tube extrudability. Antibacterial activity was assessed against Escherichia coli and Staphylococcus aureus using the agar cup plate method. Among all the formulations, F4 exhibited the best physicochemical properties and the highest antibacterial activity, indicating that an increased concentration of Leucas biflora extract enhanced the overall performance. The study concluded that the formulated herbal toothpaste could serve as a safe and effective natural alternative to conventional chemical-based toothpaste for maintaining oral hygiene.
- **Karpe *et al.* (2024)** reviewed the classification and applications of cosmetic products, with emphasis on oral care products such as

toothpaste. The authors stated that an ideal toothpaste should effectively clean teeth, remove plaque without damaging enamel, possess good stability, have a pleasant taste and odor, and be non-toxic. The review also highlighted the increasing use of herbal ingredients in toothpaste due to their safety, therapeutic benefits, and consumer acceptance. The study concluded that scientific advancements in cosmetic formulations have improved the quality, safety, and effectiveness of oral care products.

- **Rajale and Gaikwad (2024)** reviewed herbal toothpaste formulations and highlighted the importance of herbal ingredients in maintaining oral hygiene and preventing dental problems. The study reported that herbal toothpastes containing natural extracts such as guava leaves, turmeric, clove, peppermint, and camphor possess antimicrobial, anti-inflammatory, and therapeutic properties. Herbal formulations are gaining popularity due to their reduced use of synthetic chemicals and potential safety advantages. The authors discussed various evaluation parameters including pH, viscosity, foamability, moisture content, spreadability, extrudability, stability, and abrasiveness for assessing the quality of herbal toothpaste. The study concluded that properly formulated herbal toothpaste can provide effective oral care by controlling plaque, reducing microbial growth, and preventing dental disorders, making them a promising alternative to conventional toothpaste products.
- **Shahidulla *et al.* (2023)** reviewed the role of herbal toothpaste as a natural and safer alternative to conventional toothpaste for maintaining oral hygiene. The authors reported that herbal toothpastes formulated with medicinal plants such as neem, clove, tulsi, babool, and peppermint possess antibacterial, anti-inflammatory, antioxidant, and plaque-reducing properties that help prevent dental caries, gingivitis, periodontal disorders, bad breath, and tooth stains. The review highlighted that the growing preference for herbal oral care products is mainly due to their lower incidence of adverse effects and the therapeutic benefits of plant-based ingredients. It also emphasized the importance of selecting suitable herbal ingredients and formulations to ensure effective oral health management and concluded that herbal toothpaste has significant potential as a safe and effective option for daily oral care.
- **Shaikh *et al*. (2023)** conducted a preliminary in-vitro study to formulate and comparatively evaluate a polyherbal toothpaste containing natural ingredients such as neem, babul, guava, akarkara, jamun, vidanga, vajradanti, and clove oil. The formulated toothpaste was assessed for various physicochemical parameters, including color, odor, pH, spreadability, foaming ability, abrasiveness, stability, and antimicrobial activity, and its performance was compared with commercially available brands such as Dantkanti, Babool, and Colgate. The results demonstrated that the herbal formulation exhibited satisfactory physicochemical properties, good stability, and promising antibacterial activity against Staphylococcus aureus. The study concluded that the formulated herbal toothpaste is a safe and effective alternative for maintaining oral hygiene and highlighted its potential for further clinical evaluation.

AIM AND OBJECTIVES

AIM

To formulate and evaluate polyherbal toothpaste using natural ingredients for oral hygiene.

OBJECTIVES

- To prepare polyherbal toothpaste using selected herbal ingredients.
- To evaluate the prepared formulations and compare them with a marketed herbal toothpaste, including stability studies.

MATERIALS AND METHOD

RAW MATERIALS AND EXCIPIENT PROFILE:

1) NEEM

Synonyms: Margosa tree, Vepillai

Biological source: The biological source of neem is the Azadirachta indica, belonging to the family Meliaceae.

Chemical constituents: Neem (Azadirachta indica) contains several bioactive constituents, including nimbin, nimbidin, nimbolide, limonoids.

Therapeutic uses: Neem possesses antibacterial, antifungal, anti-inflammatory, antioxidant, antipyretic and other pharmacological properties. [24]

2) BABUL

Synonyms: Indian gum Arabic tree, karuvelam

Biological source: Babul is obtained from the dried bark, leaves, gum, and pods of Acacia nilotica (syn. Vachellia nilotica), belonging to the family Fabaceae.

Chemical constituents: Babul contains tannins, polyphenolic compounds, catechins, quercetin, gallic acid, α-amyrin and β-Sitosterol. The tannin content varies according to the plant part.

Therapeutic uses: Antibacterial, antifungal, antimicrobial activity, antiviral, antioxidant, antidiabetic activity, astringent, anti-inflammatory, and Gum-strengthening properties, which help maintain oral hygiene and reduce dental plaque and gingivitis. [25]

3) GUAVA

Synonyms: Koyya, Amrood

Biological source: Guava consists of the dried leaves of *Psidium guajava* L., belonging to the family Myrtaceae.

Chemical constituents: Guava leaves contain flavonoids and phenolic compounds, including quercetin, avicularin, apigenin, guaijaverin, kaempferol, hyperin, myricetin, gallic acid, catechin, epicatechin, chlorogenic acid, epigallocatechin gallate.

Therapeutic uses: Antihypertensive, antilipidemic, anticancer, antimicrobial, anti-inflammatory, antioxidant, and anti-plaque properties. They are commonly used in herbal oral care formulations to help reduce dental plaque, prevent gingivitis, and promote healthy gums. [26]

4) KALMI (CINNAMON)

Synonyms: Dalchini, Karuvapatta, Lavangapatta

Biological source: Cinnamon consists of the dried inner bark of the Cinnamomum verum J. Presl. (synonym: Cinnamomum zeylanicum Blume), belonging to the family Lauraceae.

Chemical constituents: Cinnamon bark contains up to 4% essential oil, most of which is cinnamaldehyde (60-75%), cinnamyl acetate (1-5%), eugenol (1-10%), β - Caryophyllene (1-4%), linalool (1-3%), and 1.8-Cineole (1-2 %).

Therapeutic uses: Cinnamomum verum (true cinnamon) is included in herbal toothpaste formulations due to its antimicrobial, anti-inflammatory, antioxidant, and flavouring properties. It helps control oral microorganisms, reduces plaque formation, promotes healthy gums, and provides a refreshing taste and aroma to the toothpaste. [27]

5) CAMPHOR

Camphor is incorporated as a cooling, flavouring, and antimicrobial agent. It enhances mouth freshness, provides a pleasant cooling sensation, and supports oral hygiene by helping to reduce the growth of microorganisms. For safety and comfort, it should be used in low concentration. [28]

6) HONEY

Honey is a natural humectant, sweetening agent and antimicrobial ingredient. It enhances the taste and texture of the toothpaste while helping to inhibit the growth of harmful microorganism and soothing the gums. [28]

7) CALCIUM CARBONATE:

- Abrasive Agent: Calcium carbonate acts as a mild abrasive that helps remove dental plaque, stains, and debris from the teeth's surface.
- Polishing Agent: Calcium carbonate contributes to the polishing effect of toothpaste.
- pH Buffer: Calcium carbonate helps maintain the pH balance of the toothpaste formulation.[29]

8) GLYCERIN:

Glycerin serves as a humectant helps to keep the toothpaste moist and prevent it from drying out, contributes to a smooth and creamy consistency, aids in dissolving other ingredients, and helps control the viscosity of the toothpaste, easy dispensing and spreading during brushing. [29]

9) SODIUM CHLORIDE

Sodium chloride (common table salt) is added to herbal toothpastes as a mild abrasive and viscosity adjusting agent, helping improve the texture of the toothpaste while assisting in gentle cleaning of the teeth and gums. [30]

10) SODIUM LAURYL SULPHATE

Sodium lauryl sulphate is added to provide foaming and cleansing action, helping the herbal ingredients spread evenly and improving the removal of plaque and debris from the teeth. It is generally used at 0.5-1% of the formulation to balance cleaning efficiency with reduced irritation. [29]

11) METHYL PARABEN

Methyl paraben is added as a preservative to prevent microbial contamination and maintain the quality and stability of the herbal toothpaste throughout its storage period. [30]

METHODS OF PREPARATION

A) Collection and Processing of Herbal Materials: [31]

The herbal raw materials required for the formulation (Neem stem and bark, Babul leaves, Guava leaves, and Kalmi bark) are collected. Each material undergoes the following processing steps: -

STEP 1: Cleaning

- Fresh leaves and bark are washed thoroughly under running water to remove dust, soil, and microbial contaminants.

STEP 2: Drying

- Materials are shade-dried for 7–10 days to preserve phytoconstituents and prevent thermal degradation.

STEP 3: Powdering

- The dried materials are ground using a mechanical grinder and passed through a sieve (60–80 mesh) to obtain fine, uniform herbal powders.

STEP 4: Storage

- The powders are stored in airtight containers away from direct sunlight and moisture until used in formulation.

B) Mixing and Blending Procedure: -

The toothpaste is prepared using stepwise blending method to ensure uniform dispersion of ingredients: -

1) Preparation of the Abrasive Base:

- Calcium carbonate is weighed and mixed thoroughly to form the primary abrasive body.

2) Preparation of the Humectant – Sweetener Phase:

- Glycerin and honey are mixed to create a smooth, viscous phase that prevents dryness and enhances texture.

3) Hydration of Herbal Powders:

- Neem, Babul, Guava, and Kalmi bark powders are gradually dispersed in a small portion of distilled water to form a uniform slurry.
- It ensures smooth blending and reduces lump formation.

4) Combination of phases:

- The herbal slurry is added to the abrasive base with continuous stirring.
- Glycerin–honey phase is incorporated slowly to achieve proper homogenization.

5) Incorporation of the Surfactant:

- Sodium lauryl sulfate is added carefully to avoid excessive foaming during mixing.

6) Addition of Preservatives and Additives:

- Camphor, sodium chloride and methyl paraben are blended into the mixture.

7) Adjustment of Consistency with Distilled Water:

- Distilled water is added to obtain the desired consistency of toothpaste.

8) Filling and Packaging:

- The final product is transferred into laminated or collapsible tubes and sealed.

FORMULATION [31]

SI. NO	INGREDIENTS	F1	F2	F3
1.	Neem stem and bark	1.25 g	1.75 g	2.25 g
2.	Babul leaves	1.25 g	1.75 g	2.25 g
3.	Guava leaves	1.25 g	1.75 g	2.25 g
4.	Kalmi bark	1.25 g	1.75 g	2.25 g
5.	Camphor	1.25 g	1.25 g	1.25 g
6.	Honey	1.25 ml	1.25 ml	1.25 ml
7.	Calcium carbonate	8.75 g	8.75 g	8.75 g
8.	Glycerin	5.0 ml	5.0 ml	5.0 ml
9.	Methyl paraben	0.75 g	0.75 g	0.75 g
10.	Sodium lauryl sulphate	1.25 g	1.25 g	1.25 g
11.	Sodium chloride	0.5 g	0.5 g	0.5 g
12.	Distilled water	25 ml	25 ml	25 ml

Table 1: Formulation

- **F1:** Formulation 1
- **F2:** Formulation 2
- **F3:** Formulation 3

EVALUATION

1. Physical Evaluation: [32]

The prepared toothpaste was visually examined for its colour, odour appearance, texture, smoothness, and presence of any gritty particles.

2. pH Determination: [33]

Transfer 10 gm of the toothpaste from the container in a 50 mL beaker and add 10 mL of freshly boiled and cooled water (at 27°C).

To make 50 percent aqueous suspension. Stir well to make a thorough suspension. Determine the pH of the suspension within 5 min, using a pH meter.

Normal range: 6.5–8.0

3. Spreadability: [33]

2 grams of toothpaste was placed on a glass slide (10 x 10 cm) and covered with another glass slide. Keep a weight usually (100 gram) was placed (sliding, shall not take place). The spreading (in cm) of the toothpaste was measure after 3 minutes. The procedure was repeated 2 more times and average of three Observations was noted.

Formula was used to calculate spreadability:

S=M*L/T

where,

S – Spreadability
M – weight taken in the slide
L – length moved by the slide
T – time taken to separate the upper slide by lower slide.

4. Foamability: [34]

The foaming power (foamability) of herbal toothpaste was determined by taking 2g of toothpaste with 5ml water in measuring cylinder initial volume was noted and then shaken for 10 times. Final volume of foam was noted.

Formability (%) = L1 – L2

where,

LI – Volume in ml of foam with water
L2 – Volume in ml of water only

5. Determination of moisture content: [35]

A known quantity 5g of herbal toothpaste was placed in clean porcelain dish and heated in hot air oven at 105°C until constant weight was obtained. The sample was taken out after drying then kept in desiccator until cooled to record the weight. The decrease in weight after heating indicate the presence of moisture.

% moisture content =100*M_1/M

where,

M_1 – loss of weight on drying
M – mass of the material taken for the test

6. Abrasiveness test: [36]

Abrasive agents present in toothpaste help remove stains, plaque, and food particles from teeth without damaging enamel.

Procedure:

- Take a small quantity of toothpaste.
- Apply it on a clean glass slide or tooth surface.
- Rub gently using finger or brush for a fixed time.
- Wash and observe the surface for scratches or cleaning effect.

7. Homogeneity: [37]

By applying normal force at 27°C, the toothpaste should extrude a homogeneous mass from the collapsible tube or other suitable container. Furthermore, the bulk of the contents must extrude from the container's crimp and be rolled out gradually.

8. Stability studies: [38]

The prepared herbal toothpaste formulations and marketed herbal toothpaste were stored at room temperature and under refrigerated conditions for 30 days. The samples were evaluated on the 1st and 30th days for changes in appearance, colour, odour, texture, consistency and pH. The observations were recorded and compared to assess the stability of the formulations during the storage period.

RESULTS AND DISCUSSION:

1. Physical Evaluation

Sl. No	PARAMETER	F1	F2	F3	MARKETED
1	Appearance	Blackish-brown	Blackish-brown	Blackish-brown	Light-brown
2	Taste	Characteristic	Characteristic	Characteristic	Characteristic
3	Odour	Aromatic	Aromatic	Aromatic	Aromatic
4	Texture	Smooth	Smooth	Smooth	Smooth, Fine
5	Consistency	Thick, Uniform	Thick, Uniform	Thick, Uniform	Semisolid, Spreadable

Table 2: Physical Evaluation Observation

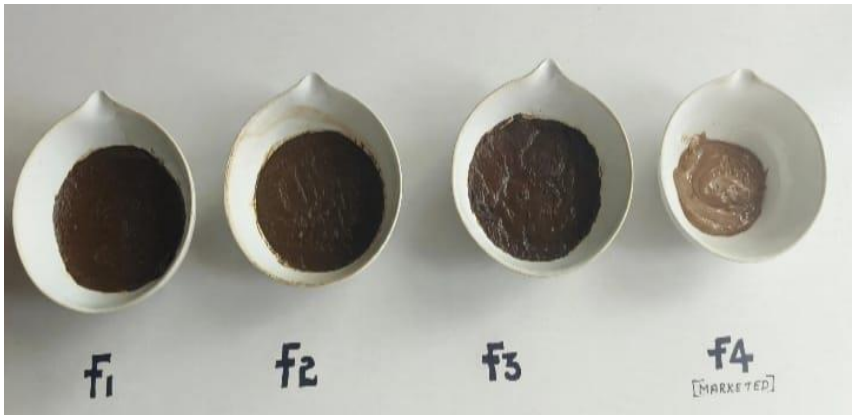


Figure 4: Physical Evaluation

The prepared formulations F1, F2 and F3 showed a blackish-brown colour, characteristic taste, aromatic odour, smooth texture and thick, uniform consistency. Compared with the marketed herbal toothpaste F4, F1 exhibited satisfactory physical characteristics with a similar smooth texture and uniform consistency.

2. pH Determination

Property	Std. Range	F1	F2	F3	F4
pH	6.5 – 8.0	7.78	7.67	7.65	7.89

Table 3: pH observation



F1



F2



F3



F4

Figure 5: pH Determination

The pH values of the prepared formulations F1, F2, and F3 were found to be 7.78, 7.67, and 7.65, respectively, while the marketed formulation F4 showed a pH of 7.89. All formulations were within the standard pH range of 6.5–8.0, indicating that they were slightly alkaline and suitable for oral applications.

3. Spreadability:

SI.NO	FORMULATIONS	DISTANCE (L)	TIME (T)	SPREADABILITY (S)
1	F1	1.8 cm	4 sec	45 g.cm/sec
2	F2	1.5 cm	3 sec	50 g.cm/sec
3	F3	1.2 cm	2 sec	60 g.cm/sec
4	F4	2.4 cm	5 sec	48 g.cm/sec

Table 4: Spreadability observation

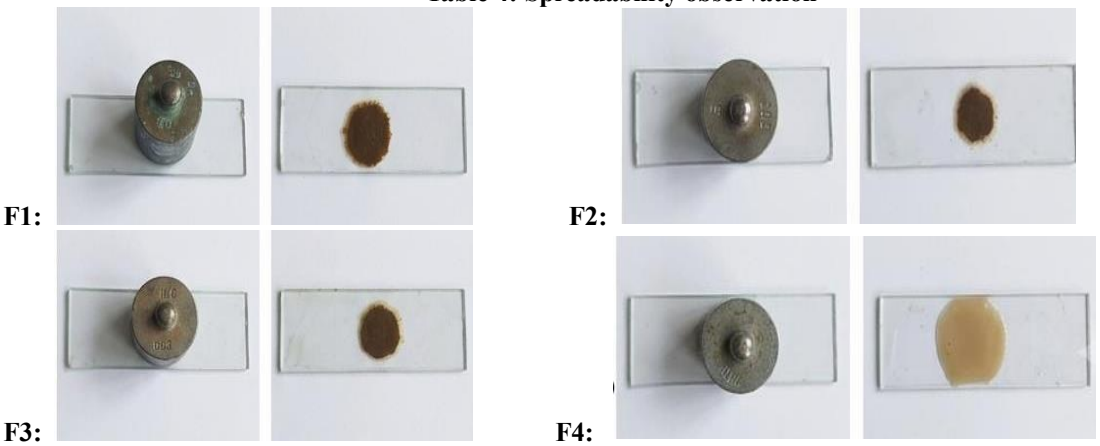


Figure 6: Spreadability

The spreadability values of the prepared formulations F1, F2 and F3 were found to be 45, 50 and 60 g.cm/sec, respectively, while the marketed formulation F4 showed 48 g.cm/sec. The prepared formulation F1 exhibited spreadability comparable to that of the marketed formulation F4.

4. Foamability:

FORMULATION	INITIAL VOLUME (ml)	FINAL VOLUME (ml)	FOAM VOLUME (ml)
F1	5.9	9.3	3.4 ml
F2	6.0	8.5	2.5 ml
F3	6.3	8.0	1.7 ml
F4	5.2	9.8	4.6 ml

Table 5: Foamability observation

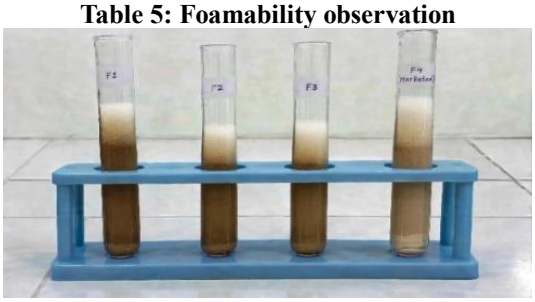


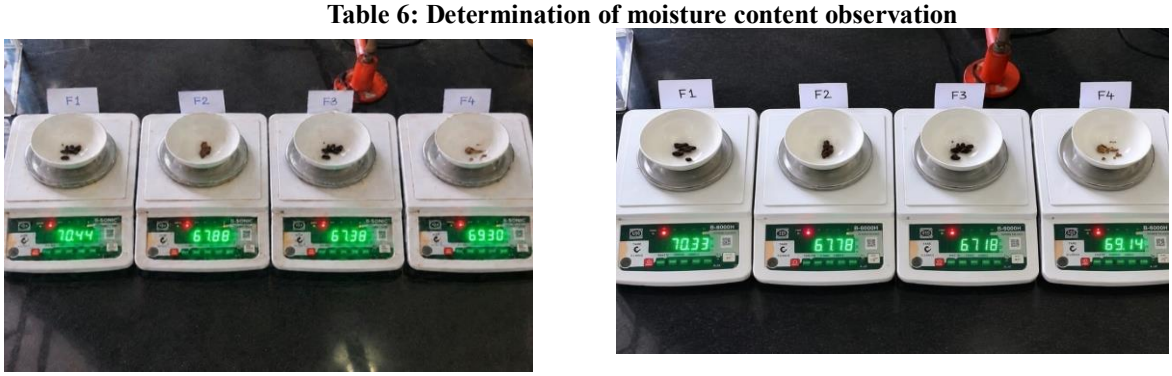
Figure 7: Foamability test

The foam volumes of the prepared formulations F1, F2 and F3 were found to be 3.4 mL, 2.5 mL and 1.7 mL, respectively, while the marketed formulation F4 showed 4.6 mL. Among the prepared formulations, F1 exhibited better foamability, although F4 showed the highest foam volume.

5. Determination of moisture content:

Formulation	Empty China Dish (g) (A)	Weight Before Drying (g) (B)	Weight After Drying (g) (C)	Initial sample weight M (g) (B – A)	Loss of weight M1 (g) (B - C)	Moisture content (%)
F1	64.98	70.44	70.33	5.46	0.11	2.01%
F2	64.13	67.88	67.78	3.75	0.10	2.67%
F3	62.07	67.38	67.18	5.31	0.20	3.77%
F4	62.71	69.30	69.14	6.59	0.16	2.43%

Table 6: Determination of moisture content observation



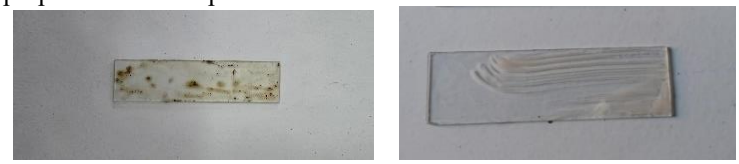
A) Before Drying **B) After Drying**

Figure 8: Determination of moisture content

The moisture content of the prepared formulations F1, F2, and F3 was found to be 2.01%, 2.67%, and 3.77%, respectively, while the marketed formulation F4 showed 2.43%. Compared with the marketed product, all three prepared formulations exhibited slightly higher moisture content, with F1 showing the closest value to F4.

6. Abrasiveness test:

The prepared herbal toothpaste and the marketed herbal toothpaste were examined for their abrasive effect on the glass slide. Both formulations showed satisfactory abrasive properties without any visible scratches, indicating good cleaning properties and acceptable abrasiveness of both formulations.



F1 **F4**

Figure 9: Abrasiveness test

7. Homogeneity:

The prepared herbal toothpaste and the marketed herbal toothpaste were visually examined for uniformity of colour, texture, consistency, and no visible lumps or phase separation. Both samples exhibited good homogeneity with a smooth and uniform appearance, indicating uniform distribution of the ingredients throughout the formulations.



Figure 10: Homogeneity test

8. Stability Studies:

Sl.NO	PARAMETER		OBSERVATION	
			ROOM TEMPERATURE	REFRIGERATION
1.	Appearance	F1	Blackish brown	Blackish brown
		F2		
		F3		
		F4	Light brown	Light brown
2.	Odour	F1	Aromatic	Aromatic
		F2		
		F3		
		F4		
3.	Texture	F1	Smooth	Smooth
		F2		
		F3		
		F4		
4.	Consistency	F1	Thick, uniform	Thick, uniform
		F2		
		F3		
		F4		
5.	pH	F1	7.76	
		F2	7.65	
		F3	7.63	
		F4	7.87	

Table 6: Stability studies observation

The prepared herbal toothpaste formulations and the marketed herbal toothpaste were evaluated for stability under room temperature and refrigerated conditions for 30 days. All formulations showed no significant changes in appearance, colour, odour, texture, consistency and pH during the storage period, indicating satisfactory stability.

CONCLUSION:

The present study was carried out to formulate and evaluate polyherbal toothpaste using selected herbal ingredients and to assess its physicochemical characteristics in comparison with a marketed herbal toothpaste. Three different formulations (F1, F2 and F3) were successfully prepared using Neem, Babul, Guava leaves and Kalmi bark powders, along with suitable excipients.

The prepared formulations were evaluated for physical characteristics, pH, spreadability, foamability, moisture content, abrasiveness, homogeneity and stability. The physical evaluation showed that the prepared formulations possessed a characteristic colour, taste and odour, with smooth texture and uniform consistency. All formulations showed pH values within the specified range, indicating suitable pH characteristics for oral applications.

The spreadability studies showed that F1 had spreadability comparable to the marketed formulation. Among the prepared formulations, F1 exhibited better foamability. The moisture content evaluation showed that F1 had the lowest moisture content among the prepared formulations. The abrasiveness test showed no visible scratches on the glass slide, indicating satisfactory abrasive properties. Homogeneity studies also revealed a smooth and uniform appearance without visible lumps or phase separation.

Stability studies were carried out under room-temperature and refrigerated conditions. No significant changes were observed in the appearance, colour, odour, texture, consistency or pH of the formulations during the storage period, indicating satisfactory short-term stability.

Based on the overall evaluation results, F1 was considered the most suitable formulation among the three prepared formulations. It demonstrated good overall physicochemical characteristics and performance comparable to the marketed herbal toothpaste.

Thus, the study demonstrates the successful development of a polyherbal toothpaste using selected herbal ingredients with satisfactory physicochemical properties. Further studies, including extended stability assessment and additional quality evaluations, may be carried out to establish its long-term quality and suitability for oral care applications.

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