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Preparation and Evaluation of Herbal Tooth Powder

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Abstract: *Herbal tooth powders made from various ingredients are extensively available in the market. Thus, modern techniques that emphasize these elements are advantageous for the standardization of herbs and their formulations. Consumers perceive that using herbal-based tooth powders is safe, effective, and has less toxicity. This research intends to offer an alternative for consumers and formulate an herbal tooth powder utilizing Clove, Neem, Babool, Tulsi, Pink salt, Cinnamon, Fennel, Alum, Mentha, and Camphor. Infections in the oral cavity are among the most common types of infections. Dental caries, which is an infectious disease, damages and infects enamel and dentine. If it is not treated, the infection continues and can eventually result in tooth loss. The mouth contains a normal flora of opportunistic bacteria that are typically non-pathogenic. An imbalance in this ecosystem can lead to infections and tooth decay. Streptococcus mutans is recognized as the main species responsible for the development of dental caries. S. mutans, which is an acid-producing bacterium, ferments carbohydrates, causing tooth decay. Consequently, this current study is designed to focus on the following aspects of herbal tooth powders: formulation, standardization of herbal tooth powder, and antibacterial testing of the herbal tooth powder extracts.*
The enamel is a composite substance comprised of hydroxyapatite. It additionally contains 70% collagen and water. Fluorine is the main element found in dentine. It comprises not only teeth but also saliva, which aids in the consumption of food. Saliva has a vital function in moistening food and preserving an ideal environment in the mouth. Dentifrices are products used to maintain oral hygiene, such as ensuring freshness in the mouth and preventing dental decay. Oral hygiene can be maintained throughout the day by utilizing different dentifrices made from both herbal and synthetic substances.

Keywords: Clove, Fennel, Antibacterial, Dental analgesic

I. INTRODUCTION

Oral hygiene is a crucial factor in maintaining a good appearance, perception of an individual, and instilling confidence. The tooth is made up of two components: the crown and the root
The crown of the tooth is covered by an outer layer known as enamel, which is the toughest tissue in the tooth.The primary composition of enamel is hydroxyapatite, and in addition.
It also contains 70% collagen and water. Fluorine is the main component of dentine. The oral cavity includes not only teeth but also saliva, which aids in the easy consumption of food. Saliva plays a significant role in lubricating food and maintaining a suitable environment in the mouth. It is produced by various glands, such as labial, lingual, buccal, and palatal glands, which are both larger and smaller, continuously producing saliva to keep the tooth environment dynamic. Saliva contains proteins, enzymes, bacteria, and mucous-polysaccharides, as well as inorganic substances like calcium, sodium, potassium, chloride, phosphate ions, and others. Plaque, calculus, and periodontal diseases are the primary concerns associated with teeth. These issues are largely caused by bacterial actions, and mineral deposits lead to calculus formation. These diseases predominantly result from a lack of proper tooth care, making it possible to prevent and control them through effective brushing with suitable toothpaste and tooth powders. Dentifrice can serve as a preventive cosmetic for teeth to help avoid tooth decay

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and bad breath. Today, dentifrice can be made with synthetic and herbal ingredients, with herbal formulations being increasingly popular due to their effectiveness and reduced side effects when compared to synthetic options. Toothpaste and tooth powders work based on their abrasive properties, as the paste and powder are applied to the teeth to rub against them, helping to remove food debris and mineral deposits. “Oral health is essential to good health and quality of life.. WHO fact sheet on oral health, 2012. All these facts draw our attention towards our traditional system of medicine, Ayurveda, which references many herbal and mineral remedies known to be effective for oral hygiene. Natural remedies are generally more accepted because they are believed to be safer and have fewer side effects than synthetic alternatives. Despite the effectiveness of various toothpaste formulas with antibacterial properties, there is a growing societal demand to utilize naturally occurring compounds for healthcare. Ayurveda has identified numerous herbs that positively impact oral hygiene and has integrated them into dental practices.

1.1 Dental care:

Tooth decay and gum disease are the result of plaque, a sticky mixture of bacteria and food. Plaque starts to accumulate on teeth within a few minutes after eating. If teeth are not properly cleaned each day, plaque will cause tooth decay or gum disease. If you do not eliminate plaque, it hardens into a deposit known as tartar that gets trapped at the base of the tooth. Plaque and tartar irritate and inflame the gums.

Bacteria and the toxins they generate cause the gums to become:

- Infected
- Swollen
- Tender

By taking proper care of your teeth and gums, you can assist in preventing issues such as tooth decay (caries) and gum disease (gingivitis or periodontitis). You should also instruct your children on how to brush and floss from an early age help them

safeguard their teeth. Plaque and tartar result in a variety of issues:

- Cavities are openings that damage the structure of teeth.
- Gingivitis is characterized by swollen, inflamed, and bleeding gums.
- Periodontitis involves the destruction of the ligaments and bone that support the teeth, often resulting in tooth loss.
- Bad breath (halitosis).
- Abscesses, discomfort, and an inability to use your teeth.

II. INFORMATION

Healthy teeth are clean and free of cavities. Healthy gums appear pink and firm and do not bleed. To maintain healthy teeth and gums, adhere to these steps:

- Floss at least once per day. It is recommended to floss after brushing. Flossing eliminates plaque that remains
- after brushing from between the teeth and on the gums.
- Brush your teeth twice a day using a soft-bristled toothbrush. Brush for no less than 2 minutes each time.
- Use fluoride toothpaste. Fluoride strengthens tooth enamel and helps in preventing tooth decay.
- Change your toothbrush every 3 to 4 months or sooner if necessary. A worn-out toothbrush won't clean your teeth effectively. If you use an electric toothbrush, change the heads every 3 to 4 months as well.
- Maintain a healthy diet. Consuming healthy foods decreases your likelihood of developing gum disease.
- Limit sweets and sweetened beverages. Consuming high amounts of sweets raises your risk of cavities. If you eat or drink sweets, brush your teeth shortly thereafter.
- Refrain from smoking. Smokers encounter more dental and gum problems than non-smokers.

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- Ensure that dentures, retainers, and other appliances are clean. This includes regular brushing. You may also need to soak them in a cleansing solution
- Schedule regular appointments with your dentist. Many dentists suggest having teeth professionally cleaned every 6 months for optimal oral health. Visiting the dentist every 3 to 4 months may be necessary if your gums become unhealthy.
- Regular dental cleaning removes plaque that may form even with diligent brushing and flossing. This is crucial for addressing areas that are difficult to access by yourself. Professional cleaning involves scaling and polishing. This process uses tools to loosen and eliminate deposits from the teeth

2.1 Collection of plant material

The plant material was collected from local market & leaves were collected from tree such as neem,tulsi, babool, cinnamon clove like ingredients were collected from local shop in the market.

The plant material was dried under the sun for 4 to 5 days & Crushed well to form a fine powder.

2.1.1 Neem

Fig(01):Neem

Synonym: Margosa, Indian Lilac.

Biological Source: Neem consists of various parts of the plant Azadirachta indica, belonging to the family. Meliaceae

Constituents: Neem contains bioactive compounds such as azadirachtin, nimbin, nimbolide, quercetin salannin. These contribute to its medicinal properties, including antibacterial, antifungal, and anti- inflammatory effects.

Uses: Neem is widely used in traditional medicine for treating skin diseases, infections, inflammation, fever and dental disorders. It is also employed in agriculture as a natural pesticide and in cosmetics for skin and haircare.

2.1.2 Tulsi

Fig (02): Tulsi

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Synonym: Holy Basil, Sacred Basil.
Biological Source: Tulsi consists of the leaves, seeds, and roots of *Ocimum sanctum*, belonging to the family Lamiaceae. **Constituents**: It contains bioactive compounds such as eugenol, ursolic acid, carvacrol, linalool, and rosmarinic acid. These contribute to its antioxidant, antimicrobial, and anti-inflammatory properties
Uses: Tulsi is widely used in traditional medicine for treating respiratory disorders, fever, stress, and skin diseases. It is also known for its adaptogenic, immunomodulatory, and hepatoprotective effects.

2.1.3 Fennel

Fig (03): Fennel

Synonym: Sweet fennel, Roman fennel
Biological Source: Fennel consists of the dried, ripe fruits of *Foeniculum vulgare* Mill., belonging to the family Apiaceae (Umbelliferae).
Constituents: Fennel contains 3–7% volatile oil, with major components being anethole (50%) and fenchone (20%). Other constituents include phellandrene, limonene, methyl chavicol, proteins (20%), and fixed oils (20%).
Uses: Fennel is used as a carminative, aromatic, stimulant, and expectorant. It is also employed as a flavoring agent in pharmaceuticals and culinary preparations.

2.1.4 Babool

Fig (04):Babool

Synonym: Indian Gum Arabic Tree, Babul, Kikar.
Biological Source: Babool consists of the bark, leaves, pods, and gum obtained from *Acacia nilotica*, belonging to the family Fabaceae (Leguminosae).
Constituents: It contains tannins, flavonoids, saponins, galactose, arabinose, and polyphenolic compounds. The bark is rich in tannins, while the gum contains calcium and magnesium salts.
Uses: Babool is widely used for its astringent, antibacterial, and anti-inflammatory properties. It is effective in treating diarrhea, dysentery, sore throat, and skin diseases. Additionally, it is used in dental care (e.g., toothpaste) and as a natural coagulant.

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2.1.5 Pudina

Fig (05):Pudina

Synonym: Pudina, Peppermint (Mentha piperita), Spearmint (Mentha spicata).
Biological Source: Mint consists of the leaves and aerial parts of plants belonging to the genus *Mentha*, family Lamiaceae.
Constituents: Mint contains essential oils rich in menthol, menthone, carvone, and limonene. It also has flavonoids, rosmarinic acid, and other phenolic compounds.
Uses: Mint is widely used for its carminative, antispasmodic, and antimicrobial properties. It is effective in treating digestive disorders, respiratory issues, and headaches. Additionally, it is used in flavoring, cosmetics, and aromatherapy.

2.1.6 Clove

Fig(06):Clove

Synonym: Lavang, Eugenia caryophyllus.
Biological Source: Clove consists of the dried flower buds of *Syzygium aromaticum*, belonging to the family Myrtaceae. **Constituents**: It contains volatile oils (mainly eugenol), tannins, flavonoids, and triterpenoids. Eugenol is the primary compound responsible for its medicinal properties.
Uses: Clove is widely used as an antiseptic, analgesic (especially for toothaches), and carminative. It is also employed in flavoring, perfumery, and as a natural preservative.

2.1.7 Cinnamon

Fig (07):Cinnamon

Synonym: Dalchini, Ceylon Cinnamon.
Biological Source: Cinnamon consists of the dried inner bark of the shoots of *Cinnamomum zeylanicum*, belonging to the family Lauraceae.

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Constituents: It contains volatile oils (mainly cinnamaldehyde and eugenol), tannins, mucilage, calcium oxalate, and starch. Cinnamaldehyde is the primary compound responsible for its characteristic aroma and medicinal properties.

Uses: Cinnamon is widely used as a carminative, stomachic, and mild astringent. It is also employed as a flavoring agent, stimulant, and antiseptic. Additionally, it finds applications in weight management, perfumery, and as a spice in culinary preparations

2.1.8 Pink salt

Fig (08): Pink Salt

Synonym: Himalayan pink salt, Sendha Namak, Sindhav Salt

Biological Source: Pink salt is a naturally occurring mineral halite, primarily sourced from the Khewra Salt Mine in Pakistan

Constituents: Composed of approximately 98% sodium chloride, with trace minerals like calcium, magnesium, potassium, and iron, which give it its characteristic pink hue.

Uses: Pink salt is used for maintaining electrolyte balance, improving digestion, relieving muscle cramps, and promoting hydration. It is also used in skincare (e.g., exfoliation) and as a culinary seasoning.

2.1.9 Alum

Fig (09):Alum

Synonym: Potash Alum, Fitkari.

Biological Source: Alum is a naturally occurring mineral, chemically known as Potassium aluminum sulfate ($KAl(SO_4)_2 \cdot 12H_2O$). It is obtained from alum-containing minerals like alunite and bauxite.

Constituents: Alum primarily consists of potassium, aluminum, and sulfate ions. It is a crystalline compound with astringent and antiseptic properties.

Uses: Alum is widely used as an astringent, styptic (to stop bleeding), and antiseptic. It is also employed in water purification, as a mordant in dyeing, and in traditional medicine for treating minor cuts, ulcers, and sore throats.

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2.1.10 Camphor

Fig(10):Camphor

Synonym: Karpura, Camphor Laurel

Biological Source: Camphor is obtained from the wood of the tree *Cinnamomum camphora*, belonging to the family Lauraceae.

Constituents: It contains terpenoids such as camphor, borneol, cineole, and safrole. Camphor is the primary compound responsible for its characteristic aroma and medicinal properties.

Uses: Camphor is widely used as a rubefacient, counterirritant, and analgesic. It is effective in relieving pain, inflammation, and congestion. Additionally, it is used in aromatherapy, religious rituals, and as a preservative.

2.1.11 Method of preparation:

Choose Ingredients: Select ingredients known for their oral health benefits, such as neem, clove, tulsi, cinnamon, Pink salt,Mint.alum,babool,Fennel &camphor.

Dry the Ingredients: Ensure all ingredients are thoroughly dried to prevent moisture in the final product. **Grind to Fine Powder**: Use a grinder or mortar and pestle to grind the dried ingredients into a fine powder. **Sieve the Powder**: Pass the ground mixture through a fine sieve to remove any coarse particles.

Mix Thoroughly: Combine the powdered ingredients in specific proportions to ensure uniformity. **Optional Additions**: Add natural flavoring agents like mint or a pinch of salt for taste, if desired.

Store Properly: Transfer the final product into an airtight container to maintain its freshness and effectivenes

III. INGREDIENTS USED IN FORMULATION OF HERBAL TOOTHPASTE:

Sr,NO	Ingredients	Amount used	Uses
1.	Neem	3.5g	Antisseptic
2.	Tulsi	6g	Bactericidal
3.	Fennel	10g	Mouth Freshner
4.	Babool	5g	Antibacterial
5.	Mint (Pudina)	2g	Antifungal
6.	Cinaamon	5g	Analgesic
7.	Clove	10g	Dental Analgesic
8.	Pink salt	10g	Gum Stenghthener
9.	Alum	10g	Anti inflammatory
10.	Camphor	4g	Analgesic

Fig: Ingredients used In formulation of Herbal Toothpaste

3.1 Evaluation Test:

3.1.1 ORGANOLEPTIC CHARACTERS:

The sample was evaluated for organoleptic characters using parameters like appearance, color, odor and taste & texture.

Colour: Yellowish brown Odor: Herbal odor like mint Taste: Like mint

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Texture: Smooth

3.1.2 Determination of Foaming Power:
The Product was taken in a measuring cylinder Its initial volume with water was noted sample is introduced & shaken for 10 times & final volume was noted.
Foaming power = V1 – V2
V1 - Volume in ml of foam with water% Moisture content = Original sampleweight−Dry sample weight/ Original sample weight X 100

3.1.3 Moisture Content : Tooth Powder (5gm) was weighed & taken in a petri dish Initial weight of sample with petri dish was measured & was kept in Hot air oven at 105degree/Celsius for 10 min & final weight was measured after 10 min.
Formula for moisture content:
% Moisture content = Original sample weight−Dry sample weight
/Original sample weight X 100

3.1.4 Bulk Density : The bulk density is a measure of untapped density (initial volume with void spaces) & tapped density (final volume with no void spaces).The overall volume is called as bulk density
It is expressed in gram/ml.
Bulk density = Untapped density – tapped density
1. Flow Property: The angle of repose is a term used to measure the maximum angle, upwards from the horizontal, at which a pile of a particular granular material will remain stable without any of the material sliding downward. It is useful in designing storage and transportation machinery for granular material as it can give an engineering insight into an appropriate size and shape of search devices.
2. Antibacterial activity: Antibacterial activity refers to the ability of a substance to inhibit the growth of or kill bacteria. This property is crucial in controlling bacterial infections and maintaining hygiene. Antibacterial agents can be natural, synthetic, or a combination of both and are commonly used in various applications, including healthcare, oral care, and personal hygiene products. Studying antibacterial activity involves evaluating the effectiveness of these agents against specific bacterial strains, often through methods like agar well diffusion, minimum inhibitory concentration (MIC), and time-kill assays. The growing concern over antibiotic resistance has also highlighted the importance of researching and developing novel antibacterial substances to address emerging health challenges.

3.1.5 Agar well diffusion method
The agar well diffusion method is a simple and widely used technique evaluate the antibacterial activity of substances like tooth powder. It involves preparing agar plates and inoculating them with a bacterial suspension. Wells are then created in the agar, and the test sample (tooth powder extract) is placed into the wells. A control, such as a standard antibacterial agent, is also included for comparison. The plates are incubated at an appropriate temperature, usually 37°C, for 24-48 hours. After incubation, the zones of inhibition—clear areas around the wells—are measured to determine the antibacterial efficacy of the tooth powder

IV. DIRECTION FOR USE

Preparation: Take a small amount of the herbal tooth powder, either by dipping a dry toothbrush into the container or sprinkling some onto your palm.
Brushing: Wet your toothbrush slightly, then use it to pick up the powder. Brush your teeth gently in a circular motion for about 2–3 minutes, ensuring you cover all surfaces of your teeth and gums.
Rinsing: Spit out the residue and rinse your mouth thoroughly with water. Clean your toothbrush as well Frequency: Use it once or twice a day, as recommended.

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4.1 Storage Conditions:

Keep it in a dry container: Toothpowder can clump or lose its texture if exposed to moisture, so always store it in a tightly sealed container.

Avoid direct sunlight: Prolonged exposure to sunlight can degrade some of the ingredients, especially natural ones like essential oils.

Store in a cool place: Heat can affect the quality of toothpowder. A cool, dry spot like a cabinet or drawer is ideal

Hygiene matters: Avoid dipping a wet toothbrush directly into the container. Instead, sprinkle or scoop out the needed amount to prevent contamination.

Label properly: If you're making or using homemade toothpowder, label it with the preparation date and ingredients for easy reference.

V. RESULT

This herbal tooth powder highlights the remarkable benefits of natural ingredients in maintaining oral health. By leveraging the antimicrobial, anti-inflammatory, and gum-strengthening properties of plants like neem, clove, babool, and tulsi, your formulation offers a safe and effective alternative to conventional chemical-based oral care products. Its ability to combat harmful microorganisms, reduce plaque, and soothe gum irritation demonstrates its efficacy as a holistic dental care solution.

This focus on traditional wisdom, combined with a modern understanding of phytochemicals, reinforces the value of herbal tooth powder as a sustainable and eco-friendly choice. This approach not only addresses common oral issues like tooth decay and gum diseases but also promotes a healthier, chemical-free lifestyle

VI. CONCLUSION

The present study acknowledges that, the importance of herbal medicament to keep teeth healthy and free from any infection. Herbal tooth powder is a natural and eco-friendly oral care solution that combines the benefits of traditional herbal ingredients with modern dental hygiene practices. It typically includes components like neem, clove, mint, salt, and other plant-based extracts, each contributing to oral health in unique ways. Neem and clove, for instance, are known for their antibacterial properties, helping to combat plaque and prevent cavities. Mint provides a refreshing breath, while salt can aid in reducing gum inflammation.

The use of herbal tooth powder promotes a holistic approach to dental care, free from synthetic chemicals and artificial additives. It is particularly beneficial for individuals with sensitivities to conventional toothpaste ingredients. Regular use leads to brighter gum & Healthier teeth.

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