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A REVIEW ON POLYHERBAL CHEWABLE TOOTHPASTE TABLET

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ABSTRACT

The present study focuses on the formulation and evaluation of a **polyherbal chewable toothpaste tablet** incorporating Miswak (*Salvadora persica*) and Orange peel (*Citrus reticulata*) for effective oral hygiene and antimicrobial protection. Toothpaste tablets, known for their portability, accurate dosing, and eco-friendly nature, were selected as a sustainable alternative to conventional toothpaste tubes. Miswak extract, a well-known natural antimicrobial and antiplaque agent, and orange peel powder, recognized for its antioxidant, mild whitening, and antibacterial properties, were incorporated using suitable excipients such as calcium carbonate, sodium bicarbonate, sorbitol, sodium cocoyl isethionate, starch, and peppermint oil to ensure cleansing efficiency, foaming ability, and palatability.The prepared chewable tablets were evaluated for appearance, hardness, friability, weight variation, pH, foamability, disintegration time, antimicrobial activity, and stability studies. The results demonstrated acceptable physicochemical characteristics and compliance with pharmacopoeial standards. Among the formulations, F3 exhibited superior antimicrobial activity, better foamability, and faster disintegration time, indicating enhanced cleansing performance and effectiveness against oral pathogens. Stability studies confirmed that the optimized formulation remained stable under both room and accelerated conditions.The development of a herbal chewable toothpaste tablet using Miswak and Orange peel was found to be safe, stable, and effective, offering a promising eco-friendly alternative to conventional toothpaste for maintaining oral hygiene.

INTRODUCTION

According to D & C Act 1940, “Cosmetics is defined as an article intended to be rubbed, poured, sprinkled, or sprayed on, or introduced into, or otherwise applied to, the human body

or any part there for cleansing, beautifying, promoting attractiveness, or altering the appearance, and includes any article intended for use as a component of cosmetic".[1]

Oral cavity

The cheeks, tongue, and hard and soft palates make up the oral cavity, sometimes known as the mouth or buccal cavity. The cheeks, which are covered by skin on the outside and a mucous membrane on the inside, form the lateral walls of the oral cavity.

The lips:

The mouth hole is surrounded by fleshy folds called lips. They are coated by mucous membranes on the inside and skin on the outside, and they include the orbicularis oris muscle. The labial frenulum connects the inner surface to the gums. When chewing, they work in tandem with the buccinator muscle to retain food between the teeth.

The vestibule:

The area between the gums and teeth and the cheeks and lips is known as the oral vestibule. The area between the teeth and the oropharynx is known as the oral cavity proper.

Palate:

The palate divides the nasal and oral chambers and forms the roof of the mouth. The maxillae and palatine bones constitute the hard palate, which is the anterior bony section. The posterior muscular part that divides the nasopharynx and oropharynx is known as the soft palate.

Glands of Saliva:

Saliva is released into the oral cavity by salivary glands. Major glands release the majority of saliva through ducts, whereas minor glands are found in the lips, cheeks, palate, and tongue.

The Tongue:

The skeletal muscle that makes up the tongue is separated by a median septum and covered in mucous membrane.

Extrinsic muscles:

Facilitate movement (in and out, side to side).

When speaking or swallowing, the form of the intrinsic muscles changes.

It has papillae on its surface.

The teeth:

The mandible and maxillae's alveolar sockets house the teeth, which are auxiliary digesting organs. Every tooth consists of a root, neck, and crown. Dentin makes up the bulk, whereas enamel, the body's toughest material, covers the crown. Blood vessels and nerves are found in the pulp cavity.Twenty deciduous (primary) teeth that sprout at six months and fall out between six and twelve years of age.Permanent Teeth are 32 and permanent molars erupt independently, while premolars take the place of deciduous molars.[2]

TOOTHPASTE TABLET

Toothpaste is a paste or gel that is used in conjunction with a toothbrush to preserve and enhance the appearance and health of the mouth. Toothpastes include flavours to freshen breath, abrasives to clean and whiten teeth, and colours to improve appearance. Conventional toothpaste tubes are composed of an aluminium and plastic laminate that is challenging to recycle.[3]

Approximately 4.15 billion toothpaste tubes are sold worldwide each year. Used toothpaste tubes are frequently thrown away and wind up in landfills, where they can take up to 500 years to break down. When they get into water bodies, they pose a serious risk to aquatic life. This problem highlights the necessity of ecologically friendly dentistry procedures, which is fuelling the increasing demand for eco-friendly substitutes like toothpaste tablets.[4]

Toothpaste tablets are a compact, chewable alternative to traditional toothpaste, designed to be chewed into a paste and used for brushing, offering a similar cleaning effect. Toothpaste tablets come in fluoride and non-fluoride options, are free from preservatives like parabens, and have a long shelf life when stored properly.They are a convenient travel-friendly option for oral care, offering a compact and portable solution for maintaining oral hygiene. They can be easily stored and used on-the-go, even without a toothbrush, making them ideal for rapid refreshment and oral care maintenance.[5]

HERBAL CHEWABLE TOOTHPASTE TABLET

A solid, environmentally friendly oral care product made with natural plant-based materials is a herbal chewable toothpaste tablet. It is intended to be chewed, creating a smooth paste in the mouth that efficiently cleans teeth, lessens plaque buildup, and aids in the prevention of gum disease. This formulation is a sustainable substitute for traditional toothpaste because it

not only promotes general oral health but also has benefits including portability, ease of use, convenience, and travel friendliness.[3]

INGREDIENTS

1.MISWAK

- Kingdom:Plantae
- Phylum:Magnoliophyta (Angiosperms)
- Class:Magnoliopsida (Dicotyledons)
- Order:Brassicales
- Family:Salvadoraceae
- Genus:Salvadora
- Species:Salvadorapersica L.

Benefits:

- Antibacterial activity: Salvadorapersica exhibits strong antibacterial action that suppresses plaque-forming and periodontal pathogens.
- Anti-inflammatory effect: It reduces gingival inflammation and bleeding through natural anti-inflammatory phytochemicals.
- Antiplaque effect:Its mechanical fibers and bioactive compounds work together to significantly decrease dental plaque accumulation.[6]

2. ORANGE PEEL

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida (Dicotyledons)
- **Order:** Sapindales
- **Family:** Rutaceae (Citrus family)
- **Genus:** *Citrus*
- **Species:** *C. reticulata* (Blanco)

Benefits

- Antioxidant activity – scavenges free radicals and reduces oxidative stress.
- Anti-inflammatory activity – alleviates inflammation in tissues and organs.
- Antimicrobial activity – inhibits growth of bacteria, fungi, and viruses.[7]

3. CALCIUM CARBONATE

Synonyms: Precipitated Calcium Carbonate ,Lime stone powder

Chemical Formula: $CaCO_3$

Molecular Weight: 100.09 g/mol

Appearance: Fine, white, odorless powder

Solubility: Practically insoluble in water; soluble in dilute acids with effervescence

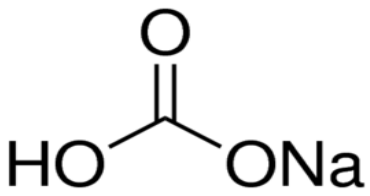
Stability: Stable under normal storage conditions; hygroscopicity very low

Category: Abrasive,filler,opacifier

Benefits:

Calcium carbonate is commonly used as an antacid for neutralizing gastric acid and as a diluent/filler in tablet formulations due to its good compressibility.[8]

4. SODIUM BICARBONATE



Synonyms: Baking Soda, Sodium Hydrogen Carbonate

Chemical Formula: $NaHCO_3$

Molecular Weight: 84.01 g/mol

Appearance: White crystalline or fine powder

Solubility: Freely soluble in water; insoluble in alcohol

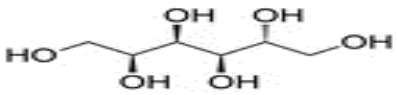
Stability: Stable in dry conditions; decomposes when heated releasing CO_2

Category: Mild abrasive, alkalizing agent, effervescent agent

Benefits:

Sodium bicarbonate ($NaHCO_3$) functions as an effervescent agent, reacting with acids to release carbon dioxide in effervescent tablets, and it also serves as an antacid and buffering agent.[9]

5. SORBITOL



Synonym: D-Sorbitol, Glucitol

Chemical Formula: $C_6H_{14}O_6$

Molecular Weight: 182.17 g/mol

Appearance: White, crystalline powder or clear viscous liquid

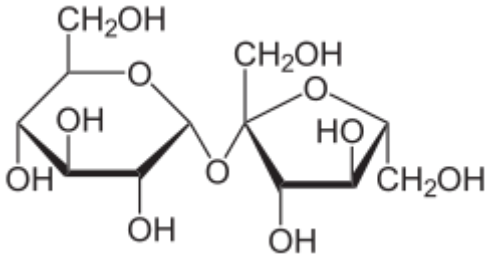
Solubility: Freely soluble in water; slightly soluble in ethanol

Category: Humectant, Sweetening Agent, Plasticizer

Benefits:

Sorbitol is widely used as a sweetening agent, a humectant that retains moisture, and a plasticizer in tablet coating and capsule formulations.[8]

6. SUCROSE



Synonym: Cane sugar, Saccharose

Chemical Formula: $C_{12}H_{22}O_{11}$

Molecular Weight: 342.30 g/mol

Appearance: White crystalline powder

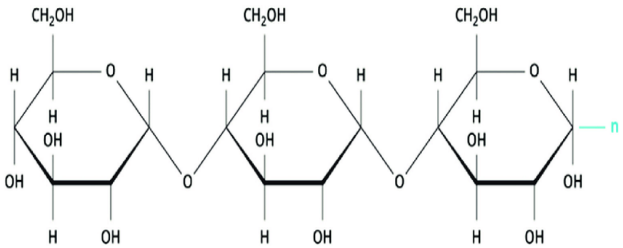
Solubility: Freely soluble in water

Category: Sweetener, Binder, Stabilizer

Benefits:

Sucrose acts as a sweetener in oral liquids, a binder in granulation, and a coating agent for tablets, providing both taste masking and structural integrity.[10]

7. STARCH



Synonym: Amylum

Chemical Formula: $(C_6H_{10}O_5)n$

Appearance: Fine, white, odorless powder

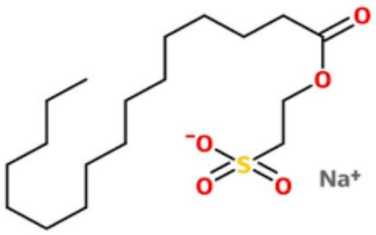
Solubility: Insoluble in cold water; swells in warm water

Category: Disintegrant, Binder, Diluent

Benefits:

Starch is used primarily as a disintegrant, promoting breakup of tablets upon ingestion, and can also serve as a binder or diluent depending on its form.[9]

8. SODIUM COCOYL ISOTHIONATE (SCI)



Synonym: Baby foam, Isethionate surfactant

Chemical Formula: $C_2H_5NaO_4S–O–CO–(CH_2)n–CH_3$ (derived from coconut fatty acids)

Appearance: White to off-white powder or noodles

Category: Mild Surfactant, Foaming Agent, Cleanser

Benefits:

Sodium cocoyl isethionate functions as a surfactant, used especially in medicated cleansing bars, shampoos, and dermatological preparations due to its mildness and good foaming properties.[11]

9. PEPPERMINT OIL

Synonym: Mentha piperita oil

Main Constituents: Menthol, Menthone, Menthyl acetate

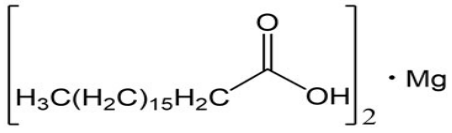
Chemical Nature: Volatile essential oil from Mentha piperita leaves

Category:Flavouring Agent, Antimicrobial Agent, Cooling Agent

Benefits:

Peppermint oil (peppermint) is commonly used as a flavouring agent and provides a cooling, soothing sensation, making it useful in antacid tablets, lozenges, and syrups.[12]

10. MAGNESIUM STEARATE



Synonym: Octadecanoic acid magnesium salt

Chemical Formula: $Mg(C_{18}H_{35}O_2)_2$

Molecular Weight: 591 g/mol

Appearance: White, fine, hydrophobic powder

Category: Lubricant

Benefits:

Magnesium stearate is the most common lubricant in tablet and capsule production, reducing friction between powders and equipment to prevent sticking and ensure smooth ejection.[8]

11. TALC

Synonym: Hydrated magnesium silicate

Chemical Formula:$Mg_3Si_4O_{10}(OH)_2$

Molecular Weight: 379.26 g/mol

Appearance: Soft, white, silky powder

Category: Glidant, Anti-caking Agent, Lubricant

Benefits:

Talc is used as a glidant to improve powder flow in tablet manufacturing and as an anti-adherent to prevent sticking during compression.[10]

ADVANTAGE

- For persons like children and the elderly, chewable tablets are more handy.
- No water is required for it to work.
- Unlike capsules and coated tablets, it is an inexpensive product that doesn't require costly equipment or a advanced manufacturing technique.
- Cut down on product waste.
- Easy to manage and enhance your housekeeping.
- Easy to use when travelling Sustainable for the environment

DISADVANTAGE

- The primary disadvantage of chewable tablets is their disagreeable flavour, which is hard to mask in a tasty chewable tablet.
- Because it is hygroscopic, it needs to be stored under specific circumstances.
- Chewable tablets need to be handled cautiously since they have less mechanical strength than regular tablets.
- Chewable tablets that cause flatulence and diarrhoea frequently contain sorbitol.
- Mouth ulcers have been connected to flavouring chemicals used in chewable pill manufacturing.

METHOD OF PREPARATION

- Accurately weigh all ingredients (miswak, orange peel, calcium carbonate, sodium bicarbonate, sorbitol, sucrose, starch, sodium cocoyl isethionate).
- Sieve each ingredient (sieve no. 10) and triturate to ensure uniform blending, then prepare starch slurry and form a wet mass.
- Pass wet mass through sieve no. 10 and dry granules at 60°C for 1 hour.
- Mix dried granules with magnesium stearate, talc, and flavor, then pass through sieves no. 22 and 44.
- Collect final granules and compress them into tablets[13]

EVALUATION

1. Oraganoleptic properties
2. Precompression parameters

a. Angle of repose
b. Bulk density
c. Tap density
d. Carr's index
e. Hausner ratio

3. Post compression evaluation

a. Weight variation
b. Hardness
c. Friability
d. Foamability
e. pH
f. Disintegration

4. Antimicrobial study
5. Stability study

CONCLUSION

- Herbal chewable toothpaste tablets were successfully formulated using Miswak and orange peel.
- The formulations showed satisfactory pre- and post-compression parameters with acceptable mechanical strength.
- FT-IR studies confirmed compatibility between active ingredients and excipients.

- The tablets exhibited adequate foamability for oral hygiene.
- The developed tablets represent a safe, eco-friendly, and effective alternative to conventional toothpaste.

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