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A RESEARCH ON: FORMULATION AND EVALUATION OF TOOTH POWDER USING HERBAL INGREDIENTS.

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ABSTRACT:

Dentifrices are the product which is used to maintain the oral hygiene such as Freshness of mouth and to avoid tooth decay. The oral hygiene can be maintained throughout the day by using various dentifrices prepared by herbal and synthetic ingredients. This work was carried out to prepare Tooth powder which can be used as a tool for proper oral hygiene and to overcome the side effect of the conventional Tooth powder prepared by synthetic ingredients.

Dentifrices are important in our daily life to maintain good oral health and hygiene. Gingivitis, plaque, Periodontal diseases are the crucial problems related to tooth. These major issues are due to poor oral hygiene and negligence in good caring of tooth. This negligence encourages plaque formation on teeth, by causing inflammation of gum tissues which ultimately leads to gingivitis and tooth loss. Most of the synthetic preparations of dentifrices, such as toothpowder and toothpaste cause side effects such as gum irritation, burning sensation and inflammation due to usage of chemicals. In this study an attempt is made to dispense an alternative to the users by formulating herbal toothpowder using Clove, Ginger, Amla, Neem Bark, Accacia Bark, Mentha Leaf, Rock Salts, Cinnamon Powder, Guava Tree Leaf and Alum. In the present work, the herbal toothpowder was formulated and standardized by analysing necessary evaluation parameters such as organoleptic, physical and phytochemical evaluation of herbal toothpowder.

This research article highlights a brief overview of risk, types and pathophysiological Treatment related to the Teeth Disease and their problems.

KEYWORDS: Herbal, Accacia Bark, Cinnamon, Synthetic, Oral hygiene

INTRODUCTION:

Toothpastes containing many ingredients are widely sold on the market. Therefore, today's method which focuses on these factors, is very useful for the standardization of herbal medicines and their formulations. Customers believe using toothpaste is safe, effective and non-toxic. Therefore, this study focused on consumer with alternative methods and developed toothpaste powder using Clove, Neem bark, Acacia bark, Rock Salt, Ginger, and Amla. Tooth decay is an infectious disease that causes damage and infection to the teeth and gums. If left untreated, the disease may persist and cause tooth loss. The oral cavity has a normal flora consisting of non-pathogenic opportunistic bacteria. This imbalance causes disease and tooth decay. Streptococcus mutants are thought to be major strains associated with dental caries development.

Dentifrices are the products which are used to maintain the oral hygiene such as freshness of mouth and to avoid tooth decay. The oral hygiene can be maintained throughout the day by using various dentifrices prepared by herbal and synthetic ingredients. Synthetic formulation contains Toxic elements such as Sodium lauryl sulphate, fluoride, Propylene glycol and various artificial sweeteners. This formulation is natural and fluoride free. Fluoride is a toxic chemical when administered in body leads to generation of disease such as Neurological and endocrine dysfunctions. Mouth is the most absorbent place in the body. The toxic chemical will be absorbed by mouth and get into the body system easily, that is the reason some medicines are administered sublingually. Tooth powder is a mildly powder that is used in combination with tooth brush to maintain oral hygiene. The manufacturing of tooth powder is a comparatively simple operation. The primary objective is the homogenous distribution of all the ingredients without contamination of foreign substances.

Herbal dentifrices help in maintaining good oral health by preventing tooth decay, bad odour from mouth, inflammations in tissues and gums, plaque formation. As oral cavity shows good absorption due to presence of mucosal membrane, blood tissues and enzymes, an individual should use safe and efficient dentifrices. Most of the synthetic tooth products use fluorides and sodium lauryl sulfate. The fluorides are toxic to human body as they cause neurological and endocrine dysfunction.1-3 Sodium lauryl sulfate is hazardous and causes irritation in mouth and neurotoxicity in body. This can be avoided by using an efficient herbal dentifrice.

The teeth are a group of hard organs found in the oral cavity. We use teeth to masticate (or chew) food into tiny pieces. They also provide shape to the mouth and face and are important components in producing speech. The teeth are a group of hard organs found in the oral cavity. We use teeth to masticate (or chew) food into tiny pieces. They also provide shape to the mouth and face and are important components in producing speech. Each tooth is an organ consisting of three layers: the pulp, dentin, and enamel.

WHO oral health fact sheet, 2012. All of these facts draw attention to the Ayurvedic medical system, which includes numerous herbal and mineral medications that are well-known for their ability to promote good oral hygiene.

Because natural medicines are thought to be safer and have less adverse effects than synthetic ones, they are more widely accepted. A growing number of people in society are choosing to rely on naturally occurring substances for health care, even though many toothpaste formulations with antibacterial qualities are effective. Ayurveda has identified numerous such herbs that have a beneficial impact on oral hygiene and have also found application in dentistry.

TYPES OF TOOTH POWDER:

1. **Whitening Tooth Powder-**
   The purpose is to freshen breath, help gums and reduce the amount of inflammation in the mouth. It is used to polish and whiten a person's teeth.
2. **Natural Tooth Powder-**
   Ingredient like sea salt which act as an abrasive, natural chalk and certain essential oils like peppermint, eucalyptus used in the natural tooth powder.
3. **Herbal Tooth Powder-**
   Sore or bleeding gums also can benefit from herbal tooth powder. Can have a variety of ingredients. Baking soda, powdered chalk, and white clay are common. Herbal tooth powder has been around for centuries and many believe it to be as essential part of any Teeth Cleaning regimen.
4. **Homemade Tooth Powder-**
   These powders also can be made at home. Homemade herbal tooth powder can be beneficial because they may cost less and the person making it will know what ingredients he is putting in his mouth or in the mouth of the children.

Tooth powder is a mildly powder that is used in combination with tooth brush to maintain oral hygiene. The manufacturing of tooth powder is a comparatively simple operation. The primary objective is the homogenous distribution of all the ingredients without contamination of foreign substances.

CHARACTERISTICS OF GOOD QUALITY HERBAL TOOTH POWDER:

- It cures tooth sensitivity.
- It cures toothache.
- It gives whitening and shining teeth.
- It removes plaques.
- It fights with bad breath and freshens it up.
- It removes stains of beverages like coffee, tea, etc.
- It cures gum sensitivity and prevents it from coming back.
- It helps to lighten up the colour of the lips.

AIM & OBJECTIVES:

The aim of presented study is Formulation and Evaluation of Herbal Tooth Powder for oral health.

The objectives of the presented study are-

1. To select the ingredients for the herbal tooth powder.
2. To perform the pre-formulation study of selected ingredients.
3. To study the organoleptic characteristics.
4. To evaluate and submit formulated herbal powder.

MATERIALS & METHODS:

COLLECTION OF HRBAL INGREDIENTS AND EXCIPIENT PROFILE

- Herbal ingredients and excipients profile were collected from the local market.

SELECTION OF HERBAL INGREDIENTS

- the formulation should involve a careful selection of herbal ingredients known for their health benefits.
- These may include herbs like Amla, Cinnamon, Clove, Guava leaf.

SELECTION OF EXCIPIENTS PROFILE

- Select an appropriate base material that will provide a mild abrasive action for cleansing teeth without being too harsh on the enamel.
- These may include Menthol crystals, Himalayan rock salt and Bentonite clay.

PREPARATION OF THE TOOTH POWDER

- The herbal ingredient were fried under shade and powdered using mixer. The powderedherbal ingredient are then passed through sieve apparatus with very fine pore diameter which can be easily mix and stored in air tight container. The powdered herbal ingredient is summarized in formulation of herbal tooth powder.

HERBAL PROFILE:

1. **CLOVE:**

Figure 1: Clove Powder

Synonym: Clove buds, Clove flowers.

Biological Source: Clove consists of the dried flower buds of Eugenia caryophyllus Thumb.

Family: Myrtaceae.

Macroscopic Characteristics:

Colour: Reddish-brown in colour, with an upper crown and a hypanthium.

Odour: Aromatic Odour.

Taste: Strong Spicy

Size Length: Generally, 10 to 13 mm long, 4 mm wide, and 2 mm thick

Shape: Unpeeled drug straight and nearly cylindrical

Microscopic Characteristics:

The transverse section should be taken through the short upper portion which has the bilocular ovary and also through the hypanthium region. The transverse section through the hypanthium shows the following characters. It has a single layer of epidermis covered with thick cuticle. The epidermis has ranunculaceous stomata. The T.S. through ovary region shows the presence of an ovary with numerous ovules in it.

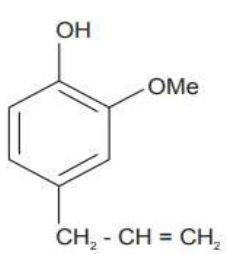
Chemical Constituents:

Clove contains 14–21% of volatile oil.

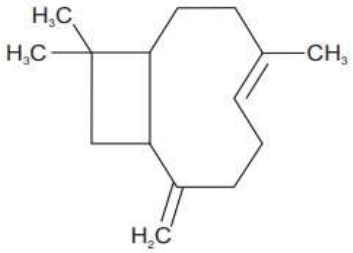
Clove oil has 60–90% eugenol, which is the cause of its anaesthetic and antiseptic properties.

α- and β- caryophyllenes, methyl furfural, gum, resin, and fibre.

Structure of Eugenol and Caryophyllenes:



Eugenol



Caryophyllene

Identification Test:

To a thick section through hypanthium of clove add 50% potassium hydroxide solution; it produces needle-shaped crystals of potassium eugenate.

A drop of clove oil is dissolved in 5 ml alcohol and a drop of ferric chloride solution is added; due to the phenolic OH group of eugenols, a blue colour is seen.

Uses:

- Dentists use clove oil as an oral anaesthetic and to disinfect the root canals.
- Clove is used as an antiseptic, stimulant, carminative, aromatic, and as a flavouring agent.

2. GINGER:

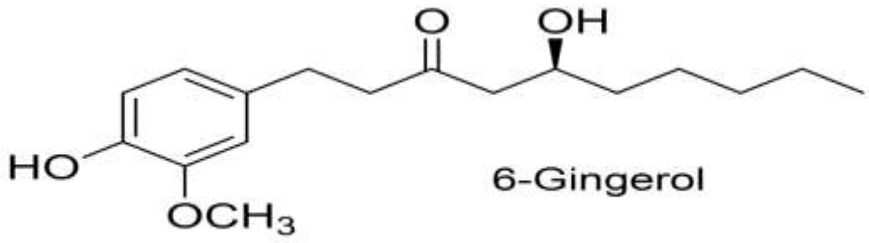
Figure 2: Ginger Powder

Synonyms: Rhizoma zingiberis, Zingibere

Biological Source: Ginger consists of the dried rhizomes of the Zingiber officinale Roscoe, belonging to family Zingiberaceae.

Chemical Constituent: Volatile oil is composed of sesquiterpene hydrocarbon like α-zingiberol; α-sesquiterpenealcohol α-bisabolene, α-farnesene, α-sesquiphellandrene. Less pungent components like gingerone and shogaol are also present.

Structure of Ginger:



6-Gingerol

Uses:

- Ginger can help to prevent cavities and remove plaque. Ginger can strengthen the gum around the teeth.
- It is also used as remedies, for painful affections of the stomach, cold, cough, and asthma. Sore throat, hoarseness, and loss of voice are benefited by chewing a piece of ginger.

3. AMLA:

Figure 3: Amla Powder

Synonym: Phyllanthus Emblica, Indian goose berry, amla.

Biological source: This consists of dried, as well as fresh fruits of the plant Emblica officinalis Gaerth (Phyllanthus emblica Linn.).

Genus: Phyllanthus

Species: P. Emblica

Family: Phyllanthacae

Microscopy:

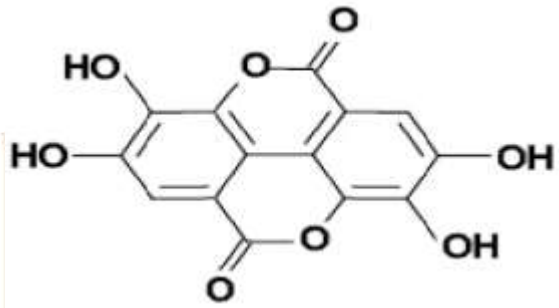
Fruit shows an epicarp consisting of epidermis with a thick cuticle and two to four layers of hypodermis; the cells in hypodermis is tangentially elongated, thick-walled, smaller in dimension than epidermal cells; mesocarp consists of thin-walled isodiametric parenchymatous cells; several collateral fibrovascular

bundles scattered throughout mesocarp; xylem composed of tracheal elements, fibre tracheids and xylem fibres; tracheal elements, show reticulate, scalari form, and spiral thickenings; mesocarp also contains large aggregates of numerous irregular silica crystals.

Chemical constituents:

It is highly nutritious and is an important dietary source of vitamin C, minerals, and amino acids. The edible fruit tissue contains protein concentration 3-fold and ascorbic acid concentration 160- fold compared to that of the apple. The fruit also contains considerably higher concentration of most minerals and amino acids than apples. The pulpy portion of fruit, dried and freed from the nuts contains: gallic acid 1.32%, tannin, sugar 36.10%; gum 13.75%; albumin 13.08%; crudecellulose 17.08%; mineral matter 4.12%; and moisture 3.83%. Tannins are the mixture of gallic acid, ellagic acid, and phyllembin.

Structure of Ellagic Acid:



Uses: Amla that support the healing and development of connective tissue of tooth gums.

4. NEEM BARK:

Figure 4: Neem Bark Powder

Synonyms: Azardica Indica, Neem tree, nimb, limba, margosa, nim tree.

Biological Source: It consist of dried powder of the leaves of the plant Azadirachta Indica.

Family: Meliaceae

Microscopy:

Almost every part of this plant is bitter. The bark is refrigerant, anthelmintic, pectoral, astringent, relives ‘kapha’ and ‘pittadosha’, vomiting, burning sensation near the hart, fatigue, fever, thirst, bad attest in month, cough2. The leaves are anthelmintic, alexeferic, insecticidal, good in ophthelmia biliousness, skin disease, cough, asthma, piles and tumours. The juice of the leaves is useful in biliousness and cure snake bite.

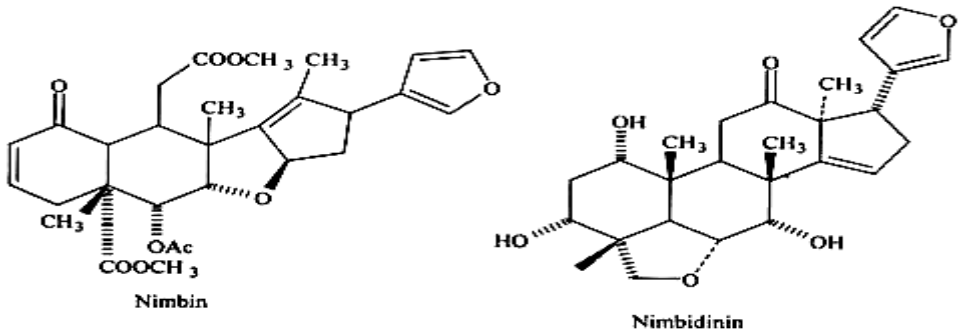
Chemical Constituents:

Nimbin, 6- desacetylnimbinene.

Nimbinene, Nimbandiol, nimbolide. A

scorbic acid, n-hexacosanol, nonacosane and amino acid.

Structure of Nimbin & Nimbidinin:



Uses:

- Neem is the anti-inflammatory, antiseptic and highly beneficial.
- This natural neem toothbrush combats teeth and gum diseases, prevents cavity, and significantly improves oral health.
- Neem bark is also used in a number of toothpaste and toothpowder and is helping in curing problems related to gingivitis.

5. ACCACIA BARK:

Figure 5: Accacia Bark Powder

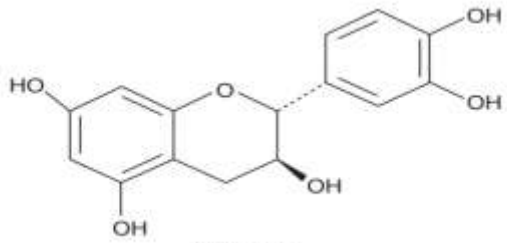
Synonyms: Babool, Black Catechu, kattha.

Biological Source: dried aqueous extract prepared from the heartwood of Acacia catechu Willdenow, belonging to family, Leguminosae.

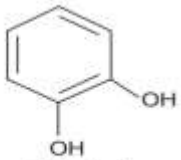
Chemical Constituents:

Cutch or black catechu resembles pale catechu or gambier in its composition. It contains about 2–12% of catechin and about 25 to 33% of phlobatannin catechutannic acid. The principle fraction of cutch has been identified as a mixture of catechin isomers which includes (-) epicatechin, acatechin, DL-acacatechin, L-acacatechin and D-isoacacatechin. It also contains 20–30% gummy matter, catechin red, quercetin and querecitin. It yields 2–3% of ash.

Structure:



Catechin



Catechol

Chemical test:

- Because of the presence of catechin, Accacia bark gives pink or red colour with vanillin and HCl.
- Lime water when added to aqueous extract of Accacia gives brown colour, which turns to red precipitate on standing for some time.

Uses:

- It is used in medicine as astringent.
- It cures troubles of mouth, diseases of the throat and diarrhoea.
- It also increases appetite.
- In India and eastern countries, it is used in betel leaves for chewing.

6. MENTHA LEAF:

Figure 6: Mentha Leaf Powder

Synonyms: Pudina Leaf, Garden mint, Mackerel mint, Green Mint.

Biological Source: Pudina consists of dried leaves and flowering tops of Mentha spicata Linn.

Family: Belonging to family Labiatae.

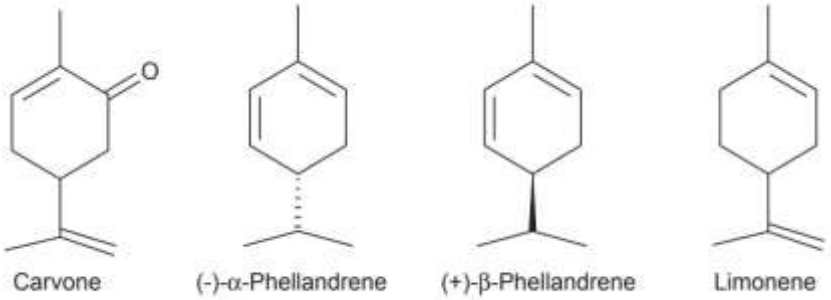
Microscopy:

From creeping rootstocks, erect, square stems rise to a height of about 2 feet, with very shortstalked, lance-shaped, acute-pointed, wrinkled, bright green leaves. It has fine-toothed edges and smooth surfaces, the ribs very prominent on the lower surface. Leaves are sessile, lanceolate to oblong, acute apex, and coarsely dentate margin. The flowers are densely arranged in whorls in the axils of the upper leaves, forming slender, cylindrical, tapering spikes, pinkish in colour. The plant has characteristic taste and odour.

Chemical Constituents:

It contains about 0.5% volatile oil containing carvone. It also contains limonene, phellandrine, dihydrocarveol acetate, esters of acetic, butyric, and caproic or caprylic acids. The drug also contains resin and tannins.

Structure:



Uses:

- Mint or Pudina, due to its Antiseptic Properties is very useful in dental care.
- It also helps teeth and gums fight off hazardous germs.
- It helps prevent the swelling in connective tissues and reduces bleeding too.

7. ROCK SALTS:

Figure 7: Rock Salt

Synonyms: Sendha Namak, Halite, saindhava lavana

Biological source: Sendha namak, a type of salt, is formed when salt water from a sea or lake evaporates and leaves behind colourful crystals of sodium chloride.

Chemical constituent:

Besides Predominantly being made up of Sodium Chloride, it also houses of vital minerals, such as Calcium, magnesium, Potassium, iron, zinc, copper, sulphur, hydrogen, oxygen and cobalt.

Uses:

Teeth Whitening Agent. Among its external benefits, rock salt has major cosmetic value as a teeth whitener. In order to give this a shot, brush your teeth with the Ayush Whitening Rock Salt Toothpaste.

8. CINNAMON:

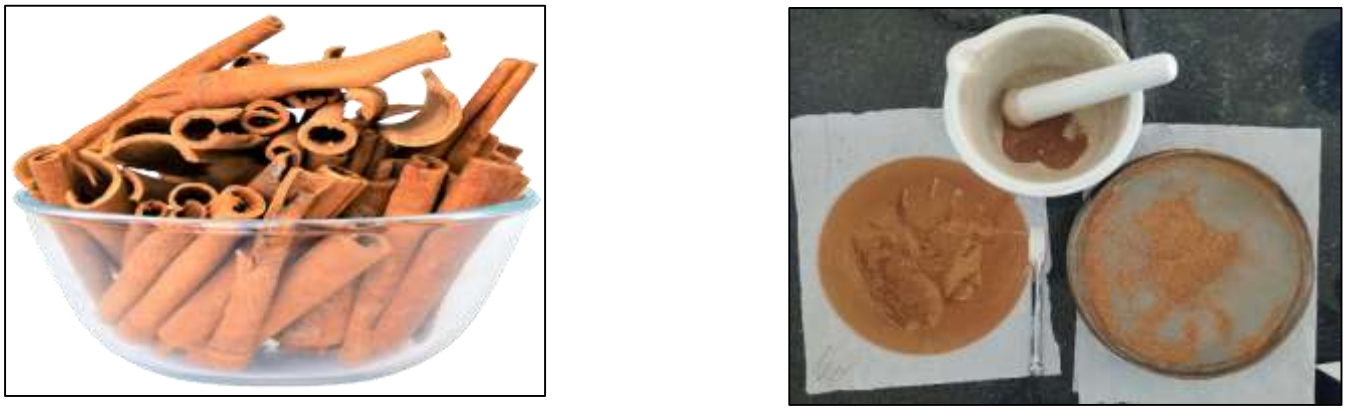


Figure 8: Cinnamon Powder

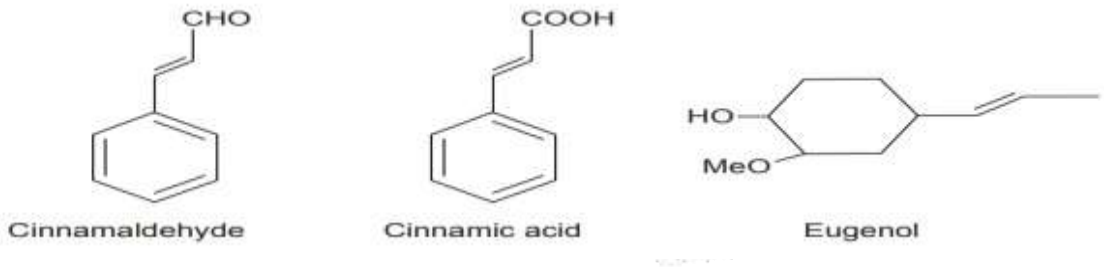
Synonyms: Dalchini, Cinnamon Bark, Cinnamomum Zeylancium

Biological source: Cinnamomum zeylanicum, the source of cinnamon bark and leaf oils, is an indigenous tree of Sri Lanka, although most oil now comes from cultivated areas.

Family: Lauraceae.

Microscopy: The transverse section shows the presence of three to four layers of sclereids which are horse shoe shaped consisting of starch grains. The pericyclic fibres (6 to 15) are present on the outer margin. It consists of sieve tubes which are completely collapsed and are arranged tangentially; lignified phloem fibres, arranged as tangential rows of four to five cells; biseriate medullary rays with needle-shaped calcium oxalate crystals.

Chemical constituent: Cinnamon contains about 10% of volatile oil, tannin, mucilage, calcium oxalate and sugar. Volatile oil contains 50 to 65% cinnamic aldehyde, along with 5 to 10% eugenol, terpene hydrocarbons and small quantities of ketones and alcohols.



Chemical Tests:

The alcoholic extract is treated with phenylhydrazine hydrochloride; it produces red colour due to the formation of phenylhydrazone of cinnamic aldehyde.

Uses:

Cinnamon Bark are pure compounds show significant antimicrobial activities against oral pathogens and could be beneficial in caries and periodontal disease prevention, endodontics, and candidiasis treatment.

9. GUAVA TREE LEAF:

Figure 9: Guava tree leaf powder

Synonyms: Common guava, Lemon Guava

Biological source: Guava trees are native to tropical America and are grown in tropical and subtropical areas worldwide. Guava fruits are processed into jams, jellies, and preserves and are common pastry fillings.

Family: Myrtaceae

Microscopy: The leaf is simple on short petiole. They are 8-12 × 3-5 cm in size and ovule in shape. Upper surface is green and globorous while lower surface is pale green and softly pubescent with the prominent principal nerves. The apex is Accuminate, the odour and taste are specific.

Chemical constituent: Guava leaves contain an essential oil rich in caryophyllene, nerolidiol, beta bisabolene, aromandreno, p-selinene. Also contain flavonoids, beta sitosterol, titerpenoides, leucocyanidins and about 10% of tannins.

Uses: Guava leaves have long been used effectively for oral hygiene due to their antibacterial and antimicrobial properties. These properties have a positive effect on controlling plaque.

10. ALUM:

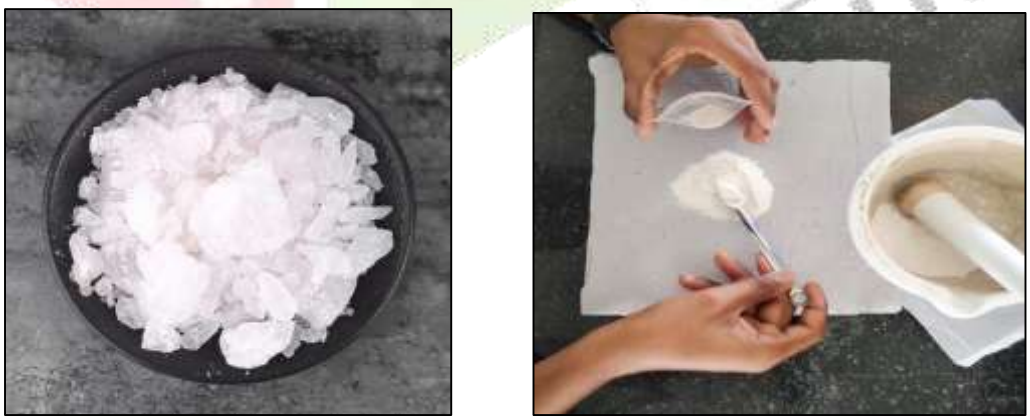


Figure 10:Alum powder

Synonyms: Potassium Aluminum Sulphate

Biological source: Alums occur naturally in various minerals. Potassium alum, for example, is found in the minerals kalinite, alunite, and leucite, which can be treated with sulfuric acid to obtain crystals of the alum.

Chemical constituent: Aluminum sulfate is an aluminum salt composed of aluminum, sulfur, and oxygen, three plentiful elements. Its molecular formula is Al2(SO4)3 or Al2S3O12 or Al2O12S3.

Chemical Tests: Chemical test of alum containing qualitative and Quantitative test of chemistry Such as Sulphate Ion test, Melting Point and Boiling Point Etc.

Uses: Alum mouthwashes used for its properties like astringent, anti-plaque, anti-gingivitis, antimicrobial, antiseptic, anti-calculus, decreasing dentinal hypersensitivity, prevention of halitosis, reduction of enamel dissolution, and symbiotic activity with fluoride.

MATERIALS USED:

Sr. no	Name of herb	Uses/ properties	Name of suppliers
1.	Clove	Pain relieving & Antiseptic	Ayurvedic store
2.	Ginger	Whitening & Strengthening agent	Pure organio
3.	Amla	Astringent	Nutri.org
4.	Neem bark	Antimicrobial/ Antioxidant	Ayurvedic store
5.	Acacia bark	Antimicrobial	Ayurvedic store
6.	Mentha leaf	Antiseptic	Vegetable market
7.	Rock salt	Cleansing agent	Ayurvedic store
8.	Cinnamon powder	Remineralizing agent& preservative	Ayurvedic store
9.	Guava tree leaf	Relive tooth ache	Nutri.org
10.	Alum	Rapid relief	Ayurvedic store

EQUIPMENT USED:

There is many equipment which are used from Laboratory in this Herbal Preparation Models are as follows:

Sr. no	Equipment	Models	Diagrams
1.	Hot air oven	MULTISPAN	
2.	Mixer	MARVEL	
3.	Weighing balance	VIRGO SF 400D	
4.	Digital PH. meter	DELUX ME 963P	
5.	Tapped density apparatus	VTAP Matic 2	

FORMULA:

Sr. no	Name of herb	F1	F2	F3
1.	Clove	4.0 gm	4.0 gm	4.0 gm
2.	Ginger	2.0 gm	2.5 gm	3.0 gm
3.	Amla	2.0 gm	2.5 gm	3.0 gm
4.	Neem bark	3.0 gm	2.5 gm	2.0 gm
5.	Accacia bark	3.0 gm	2.0 gm	3.0 gm
6.	Mentha leaf	2.0 gm	2.0 gm	1.5 gm
7.	Rock salt	3.0 gm	4.0 gm	4.5 gm
8.	Cinnamon powder	4.0 gm	3.5 gm	3.0 gm
9.	Guava tree leaf	2.0 gm	2.0 gm	1.0 gm
10.	alum	5.0 gm	5.0 gm	5.0 gm

EVALUATION OF POWDER:

1. Organoleptic Characteristics:

Texture	Soft
Taste	Bitter/ Astringent
Odour	Characteristic
colour	Yellowish green

2. Determination of pH:

Firstly, we weigh 1gm of sample and the mixed it in 10ml beaker with diluent water. Then calibrated the PH meter with standard alkali solution ,7Ph alkali solution. After we have taken the sample measured the PH. is 6.

3. Moisture Content:

Tooth powder (10gm) weighed and dried it in the oven at 105°C then it was cooled. The loss of weight is recorded as percentage moisture content and calculated by the given formula.

$$\% \text{ Moisture content} = \frac{\text{Initial weight of sample} - \text{Final (Dry) weight of Sample}}{\text{Initial Weight of Sample}} \times 100$$

4. Bulk Density:

The bulk density of the powder is the ratio of the mass of an untapped powder sample and its volume including the contribution of the inter-particulate void volume. It is expressed in gram/ml.

$$D = \text{Mass} / \text{Volume}$$

5. Tapped Density:

The tapped density of powder is the ratio of mass of powder sample and its volume after tapping it 100 times by digital tap density meter. It is expressed in gram/ml.

$$D = \text{Mass} / \text{Tapped Volume}$$

6. Angle of Repose:

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.

$$\text{Angle of Repose } \theta = \tan^{-1} h/r$$

7. Abrasiveness:

It was evaluated manually.

8. Carr's Index:

Carr Index of any solid is calculated for compressibility of a powder which is based on true density (ρT) and bulk density (ρB).

$$CI = 100\ [(\text{True Density} - \text{Bulk Density}) / \text{Bulk Density}]$$

9. Hausner Ratio:

The Hausner ratio is a number that is correlated to the flowability of a powder or granular material.

Hausner ratio can be Calculated as formula –

$$Hr = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

SUMMARY AND CONCLUSION:

The ingredient used in the present work was selected to pass antibacterial effect and to maintain oral hygiene. Any herbal toothpowder is considered safe to used twice a day and it does not cause any harmful effects, instead imparts good freshness and away from bad odour. Oral hygiene can be maintained in a reliable, safe and inexpensive way by using herbal tooth powder. In the study, it was found that Natural plant products are an important source to control bacterial pathogens. Our herbal tooth powder is considered safe to use twice a day and it does not cause any harmful effects, instead, it imparts good freshness and away from bad odour.

It was concluded that our formulation passes all evaluation test with marketed tooth powder.

Sr. No	Parameters	Our Formulation	Marketed Powder (Vicco)
1	**Bulk Density**	0.51 gm/ml	0.60 gm/ml
2	**Tapped Density**	0.72 gm/ml	0.90 gm/ml
3	**Angle of Repose**	41.98^{o}	37.99^{o}
4	**Determination of pH**	3.58 (Acidic)	3.92 (Acidic)
5	**Moisture Content**	6 %	5.5 %
6	**Carr's Index**	41.27	50
7	**Hausner Ratio**	1.4	1.5

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