INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Formulation And Evaluation of Herbal Tooth Tablet

Khadeeja P.*, Haseeba Palakkodan, Mubashira P., Reema Abdul Latheef, Sreya C. V., Sharanya R. K.

Rajiv Gandhi institute of pharmaceutical sciences and research, Trikaripur, Kasargod, India, 671310.

ARTICLE INFO

Published: 16 June 2025
Keywords:
Herbal Tooth Tablet, Anti-Bacterial, Dental Care, Guava Leaf, Miswak, Clove Oil
DOI:
10.5281/zenodo.15709191

ABSTRACT

Herbal tooth tablets can be prepared by using different herbal extract of many crude drugs. They have antibacterial, anti-microbial and analgesic activity. Herbal tooth tablet with natural ingredients is more acceptable than chemical based synthetic formulation. They are safe, reducing dental caries and preventing other dental disorders. In this composition, we used clove oil, extracts of guava leaves and miswak all of which have never been used together before in any research. These extracts have anti-ulcer, anti-caries, anti-bacterial, as well as certain unique properties including antioxidant, anti-fungal, analgesic and anti-microbial activity. Being in tablet form they are easy to transport and easy to store. They are in tablet form, so no wastage as the exact amount is being used. Tablets being dry there is minimal preservatives and hence it's safe. The physicochemical evaluation of selected plants was within the pharmacopeial limit and phytochemical screening in ethanol and water extract showed the intensive presence of constituent such as alkaloids, glycosides, tannins, volatile oils etc. The formulated herbal tooth tablet was evaluated to determine important pre-compression and Post-compression parameters in order to develop a more effective and stable product. The purpose of this project is to make and test herbal tooth tablet. This research proves that our herbal-based tooth tablet formulation with natural ingredients is as excellent as it gets in terms of performance.

INTRODUCTION

Herbal Formulations

Herbal formulations are dosage form consisting of one or more herbs or processed herbs in specified quantities. It provides specific nutritional, cosmetic benefits. It is used to diagnose, treat, mitigate diseases of human beings or animals, alter the structure or physiology of human beings or animals. Herbal formulation contains an active substance or herbal substance in combination with one or more herbal preparations. Herbal

***Corresponding Author:** Khadeeja P.
Address: *Rajiv Gandhi institute of Pharmaceutical Sciences and Research, Trikaripur, Kasaragod, India, 671310.*
Email ✉: khadeeja1206@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

formulations are obtained by subjecting the various herbal substances for extraction, distillation expression, fractionation, purification, concentration or fermentation.

ADVANTAGES

- Herbal formulations are used to treat the cause of the issue, not just mask the symptom, because herbal medicines contain vitamins, antibodies and other health promoting agents.
- They are less toxic and have less side effects compared to synthetic drugs.
- It helps to strengthen the overall body not just illness of the body.
- They are effective, specific, stable, and potent.

DISADVANTAGES

- They may cause other problems if you're taking other medicines.
- Herbal medicines may produce bad reaction or side effects.
- Not all herbal medicines are regulated.
- The effectiveness of herbal medicines are generally very limited and produce slow actions.

Herbal Cosmetics

Herbal cosmetics are formulated by using one or more cosmetic herbal ingredients, which are used to cure various skin aliments. Plant parts are highly used for the development of new drug products for cosmeceuticals and pharmaceutical applications. The best thing of herbal cosmetics is that it is purely made by herbs and shrubs and thus is side effect free. The natural content in the herbs does not have any side effects on the human body; instead provides the body with nutrients. The demand of herbal medicine is increasing rapidly , because of their skin friendliness and lack of side effects.

Classification of Herbal Cosmetics

Herbal Tooth Tablet

Herbal tooth tablets are chewable tablets and are tiny little circular discs . They are made entirely of natural components that are designed to keep our teeth clean by eradicating plaque. The tooth tablets are formulated by dry components of toothpaste .

Simply place it in your mouth, moisten your toothbrush, crush the tablet with teeth and agitate the tablet with the bristles like a cleanser. The tablets can come in reusable jars or packed in recyclable materials. The cleaning benefits are the same as toothpaste . Tablets being dry there is minimal or no preservatives at all and hence it's safe and eco-friendly. Being in tablets form they are easy to transport hence low carbon footprint. Sometimes toothpaste might get highly squeezed out , which will not happen in tooth tablets. They are easy to store. They are in tablet form, so no waste as the exact amount is being used. Especially during covid pandemic, the tooth tablets are safer and better option. More than anything hygiene no passing of germs when the tube is swiped from brush to brush. Our mouths go from remineralization to demineralization throughout the day. For the natural remineralization, the mouth should not be in an acidic state but in an alkaline state. The type of sugary foods, drinks such as coffee and tea keep the mouth mostly in an acidic state. which attacks the enamel. It can take hours for the balance condition , but tooth tablets can help quicken it. The proposed research tooth tablets recommend just crushing the tablet in mouth , then swishing for 15 to 20 seconds for a quick alkalizing after a meal or coffee can keep the teeth clean.

ADVANTAGES:

- The herbal tooth tablets are convenient form for people from youngsters to the elderly.
- It doesn't need the use of any water.
- It is a low-cost product;unlike capsules and coated tablets, it does not require expensive equipment or a sophisticated manufacturing process.
- Reduce product waste.
- Simple to solid handling.
- Improve your housekeeping.
- Simple to use while traveling.
- Eco friendly and easy to use.
- Increase patient tolerance.

DISADVANTAGES:

- The biggest drawback of the herbal tooth tablet is that they have an unpleasant flavor, it is difficult to mask the unpleasant taste of chewable pill.
- The are hygroscopic in nature, so it require special storage condition.
- Chewable tablets have less mechanical strength than conventional tablets, they must be handled carefully.
- Flavoring compounds used in the manufacture of chewable pills may lead to mouth ulcers.

MATERIALS AND METHODS

Plant Collection

The fresh leaves of Psidium guajava were collected from Kasaragod district, Kerala (India) in the month of October 2024.The fresh bark of Salvadora persica were buy from market. The herbarium was prepared by drying the specimens in the shade and then labeling them with the relevant information.

Plant Authentication

The plant material was identified and authenticated by Dr. Sonia N S, Assistant professor (horticulture), College of Agriculture Padnekad, Kasaragod, Kerala.

Plant Profile

Psidium Guajava

Synonyms

Psidium guajava, *Psidium* pomiferum , Psidium pyriferum , guajava pyrifera , Psidium guineense SW, Psidium cujavus.

Scientific classification of *Psidium guajava*

Kingdom	Plantae-plants
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Genus	Psidium
Species	Psidium guajava

Morphological characteristics

Psidium guajava is a small evergreen tree in the myrtacae family that grows to height of 3-10 meters, straight smooth and grayish brown trunk and spreading slender and pubescent branches. Leaves are simple, which are oppositely arranged and are decussate. It has elliptic, ovate or lanceolate shape and have size ranging from 4-10 cm long and 2-5cm wide. The leaves contain pubescent, and prominent veins as surface. Flowers are arranged in a ring and are small white and fragrant. Fruits are berry, oval, or spherical in shape.it have 3-10 cm diameter. The color of fruit is green, yellow, or red when ripe and it contains soft, juicy and sweet pulp with many small seeds. The seeds are small numerous and embedded in the pulp have a shape of reniform & kidney shaped with brown or reddish-brown color.

Phytochemical constituents

- Vitamins such as vitamin C, vitamin A, vitamin B2, and vitamin E.
- Flavonoids such as quercetin, kaempferol and myricetin.
- Phenolic acid such as Gallic acid, Ellagic acid and Ferulic acid.
- Tannins such as Condensed tannins, Hydrolysable tannins and Catechins.
- Saponins such guava saponin A,B,and C.
- Terpenoids such as limonene,β-caryophyllene, and α-pinene.
- Carotenoids such as lycopene β-carotene, lutein.
- Minerals such as potassium, magnesium, manganese and copper.
- Glycosides such as Gauvin A, B, and C.
- Alkaloids such as guavine, and psidine.

Medicinal uses

Antibacterial, anti-fungal, antioxidant, anti-inflammatory, anti-diabetic, cardiovascular health cancer prevention.

Salvadora persica

Synonyms

Salvadora oleoides, Salvadora indica, *Salvadora persica.*

Scientific classification of *Salvadora persica*

Kingdom	Plantae-plants
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Brassicales
Family	Salvadoracea
Genus	Salvadora
Species	Salvadora persica

Morphological characteristics

Salvadora persica is a small to medium sized tree, typically growing up to 3-6 meters tall. The stem is straight, with a smooth, grayish brown bark that peels off in thin layers. The branches are spreading, with a rounded crown. The leaves are elliptical or ovate, with a pointed tip, typically, 2-5 cm long and 1-2 cm wide, and they are arranged oppositely on the stem. It produces small, greenish yellow flowers and are arranged in axillary clusters. The fruit is small, red or purple and are typically 1-2 cm in diameter. It has a deep taproot system.

Phytochemical constituents

- Alkaloids: Salvadorine and trimethylamine.
- Sulfur Compounds: Benzyl isothiocyanate (BITC) and elemental sulfur.
- Flavonoids: Kaempferol, quercetin, and rutin.
- Glycosides: Salvadoside and salvadoraside.
- Sterols: β-sitosterol and stigmasterol
- Vitamins and Minerals: High levels of fluoride, calcium, phosphorus, and vitamin C
- Silica and Saponins.

Medicinal uses

Helps in oral health (Antibacterial , Antigingivitis , Tooth-whitening , Strengthens enamel), anti-microbial activity , anti-inflammatory and analgesic, anti-oxidant, gastro intestinal benefits , anti-diabetics effect etc.

Extraction Of Plant Material

1. Extraction of guava leaves

Extraction of *Psidium guajava* was carried out by maceration.

The collected plant material of *Psidium guajava* is shade dried and coarsely powdered.10gm of powder is placed inside a container, the menstruum (70% alcohol) is poured on top until completely covered the drug material. Then it is allowed to stand for 48 hours with occasional shaking. Extract was filtered through Whatman No.1 filter paper and the filtrate is used to detect various biologically active constituents present in various solvent extracts.

2. Extraction of miswak

Extraction of *Salvadora persica* was carried out by maceration.

The collected plant material of *Salvadora persica* is shade dried and coarsely powdered.10gm of powder is placed inside a container, the menstruum (70% alcohol) is poured on top until completely covered the drug material. Then it is allowed to stand for 48 hours with occasional shaking. Extract was filtered through Whatman No.1 filter paper and the filtrate is used to detect various biologically active constituents present in various solvent extracts.

Pharmacogenetic Study

A. Determination of moisture content

B. Determination of ash value

- Total ash
- Acid insoluble ash
- Soluble ash

C. Determination of extractive value

- Alcohol soluble extractive value
- Water soluble extractive value

Preliminary Phytochemical Screening

Preliminary phytochemical screening of the extracts was done in water and alcohol. The extracts were subjected to various chemical tests such as chemical test for alkaloids, glycosides, flavonoids, carbohydrates, saponins, phytosterols, tannins , phenolic compounds, proteins and amino acids to detect various phytochemical constituents. The ethanol extracts of *Psidium guajava* and *Salvadora persica* show more positive effect . So ethanol extract is used in the preparation of tooth tablet.

Formulation Of Herbal Tooth Tablet

SL.NO	Materials	Functions	F1	F2	F3
1	Guava leaf	Anti-microbial activity	3g	3g	3g
2	Miswak	Prevent tooth decay& strengthen tooth enamel	2.5g	2.5g	2.5g
3	Clove oil	Treat bad breath	1.5ml	1.5ml	1.5ml
4	Calcium carbonate	Abrasive	14g	14g	14g
5	Sodium lauryl sulphate	Detergent	1g	2g	3g
6	Acacia	Binder	2g	2.5g	3g
7	Sodium saccharine	Sweetener	0.55g	0.55g	0.55g
8	Talc	Lubricant	3g	3g	3g
9	Sodium benzoate	Preservative	0.45g	0.45g	0.45g
10	Menthol	Flavoring agent	0.75ml	0.75ml	0.75ml
11	Magnesium stearate	Glidant	2g	2g	2g

Procedure

1. Weigh all the powdered ingredients Calcium carbonate, Sodium lauryl sulphate ,Acacia Sodium saccharine ,Talc, Sodium benzoate ,Magnesium stearate required for the formulation. Mix all the powdered ingredients in the mortar and pestle. Triturate them for size reduction and uniform mixing.
2. Then add clove oil , menthol and weighed herbal ingredients like guava leaf & miswak extract to the above mixture again blended well to form uniform mixture
3. After that the mixture is allowed to pass through sieve no 8 and the granules were dried by Using hot air oven at 50°C for 15-20 minutes. Then the dried granules are again allowed to passes through sieve no. 22.
4. By using direct compression method tooth tablets were produced by punching the above dried granules with single punch machine.

Evaluation Of Herbal Tooth Tablet

A. Physical Evaluation

Physical parameters such as state, colour, appearance were evaluated.

B. Pre-Compression Evaluation:

Before compression the flowability properties of granules and powders were characterized by the

angle of repose, flow rate, bulk density, tap density, compressibility index (carr's index) , percentage porosity, and Hausner's ratio.

Angle of repose

The angle of repose is defined as the maximum angle possible between the surface of a pile of powder and the horizontal plane. The frictional force in a loose powder or granules can be measured by the angle of repose is an indicator of the powder flow property.

$\tan \theta = h / r, \quad \theta = \tan^{-1} (h/r)$

Where,

θ is the angle of repose h is the height of the pile

Procedure:

At definite height (h) the funnel was fixed to a stand through which the powder was allowed to flow. The angle of repose was then calculated by measuring the height and radius of the heap of the powder. Care was taken to see that the powder particles slip and roll over each other through the sides of the funnel. r is the radius of the base of the pile.

Angle of repose as an indication of powder flow

The angle of repose or degrees	Flow
< 25	Excellent
25 – 30	Good
30 – 40	Passable
> 40	Very poor

i. Bulk Density:

The bulk density is defined as the ratio of the mass of the powder by the bulk volume in cm3. The sample was carefully introduced into a 100 ml graduated measuring cylinder. This cylinder was dropped at 2 seconds intervals onto a hardwood surface 3 times from a height of 1inch. The bulk density of each formulation was then obtained by dividing the weight of the sample in grams by the final volume in cm3 of the sample which is contained in the measuring cylinder. It was calculated by using the following equation.

Bulk Density = Mass / Bulk Volume

ii. Tap Density:

The tap density is defined as the ratio of the mass of the powder by the tapped volume in cm3. The sample was carefully introduced into a 100 ml graduated measuring cylinder. This cylinder was dropped at 2 seconds intervals onto a hardwood surface 100 times from a height of 1inch. The tapped density of each formulation was then obtained by dividing the weight of the sample in grams by the final tapped volume in cm3 of the sample which is contained in the measuring cylinder. It was calculated by using the following given equation.

Tap Density = Mass / Tap Volume

iii. Carr's index:

Carr's index which is also called as % compressibility index. It is an indirect method of measuring the flow of granules using the bulk densities. It was developed by Carr. The % compressibility of a powder was a direct measure of the potential powder or bridge strength and the stability of the granules. Carr's index of each formulation was calculated by using the following equation.

% Compressibility = ((Tap Density-Bulk Density)/Tap Density) 100

Carr's Index as an indication of powder flow

Compressibility index	Flow
5 – 15	Excellent
12 – 16	Good
18 – 21	Fair to passable
23 – 35	Poor
33 – 38	Very poor
> 40	Very very poor

Post compression evaluation:

iv. Weight variation:

Weight variation was done to check whether different batches of tablets have uniformity. Weighed 20 tablets individually, calculated the average weight, and compared the individual tablet weight to average. If not more than two tablets are outside the percentage limit and none of the tablets differ by more than two times the Percentage limit, the tablets meet the test.

Weight variation specification as per I.P.

Average weight (mg)	Maximum % difference
130 or less	10%
130 – 324	7.5%
> 324	5%

v. Hardness:

The hardness of the tablet was evaluated by using a Monsanto hardness tester. It consists of a barrel containing a compressible spring held between two plungers. A lower plunger was placed in close contact with the tablet and a zero reading was taken. By turning a threaded bolt, the upper plunger was forced against a spring until the tablet fractures. The force of fracture was recorded. Ten tablets of each formulation were evaluated.

vi. Friability:

Roche friability is used to evaluate the friability of 20 tablets from each formulation. Pre weighed tablets were placed in the friabilator plastic chamber and the friabilator was run for 4 minutes at 25 rpm. All the tablets were deducted and weighed by the following Formula39.

% friability = ((initial weight – final weight) / initial weight) 100

vii. Foamability:

The foamability of the formulated product was estimated by adding a tablet into a 100 ml graduated measuring cylinder containing the required amount of distilled water. The initial volume of the measuring cylinder was recorded. Then the measuring cylinder was shaken 10 times. The final volume was recorded after the production of foam.

Foam expansion = volume of foam / volume of solution

viii. pH:

The pH of the solution was measured using a pH meter by dissolving 3 tablets in 3 beakers containing 200 ml of water.

ix. Disintegration time

The disintegration test is used to show how quickly the tablet breaks down into smaller particles, allowing for a greater surface area and availability of the drug when taken by a patient. Disintegration tests are however, useful for assessing the potential importance of formulation and process variables on the biopharmaceutical properties of the tablet, and as a control procedure to evaluate the quality reproducibility.

- Six tablets were added in the disintegration apparatus ,three with disc and other three without disc.
- The apparatus was dipped into beaker containing distilled water at room temperature

and disintegration time was recorded for each tablet.

- The 1,2,3,4,5,6, tablet was disintegrated at 1.98sec,1.95,1.96,1.97,1.95,1.97 and therefore the average time taken for disintegration was 2mins.

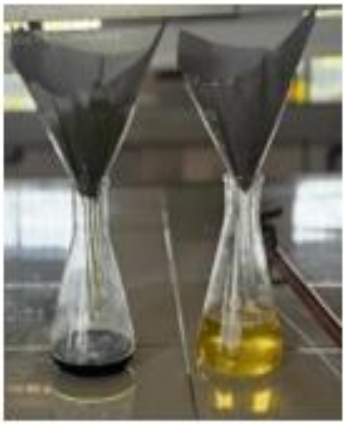
RESULT AND DISCUSSION

Plant collection and drying

Collected plant materials were identified and authenticated by Dr. Sonia N S Assistant professor (horticulture),college of Agriculture Padnekkad , Kasaragod , Kerala , *Psidium guajava and Salvadora persica.*

Preparation of plant extracts

The collected plant materials are subjected to extraction using various solvents such as ethanol and water . The extracts obtained after maceration process was the used for phytochemical studies to choose the most suitable solvent for further extraction.

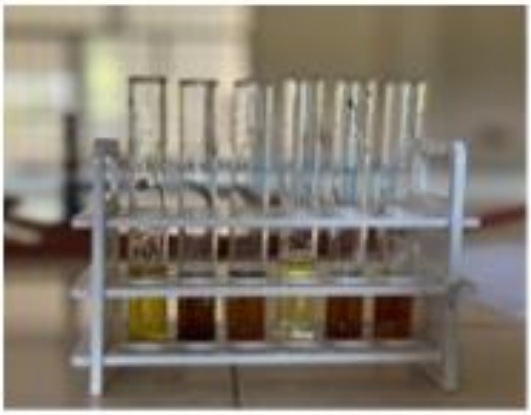

Physico-chemical parameters

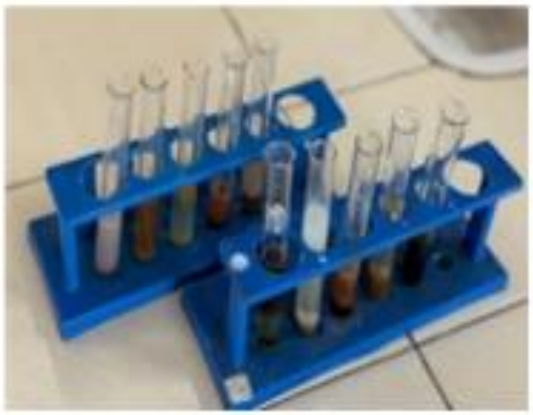
After the collection of plant material ,they were shade dried. Physico chemical parameters of plant were tabulated in table number parameters such as ash value , extractive values , and moisture content were estimated.

SL NO:	Test	Psidium guajava	Salvadora persica
1	Total Ash(%w/w)	8.25	6.8
2	Acid insoluble Ash(%w/w)	6.3	2.8
3	Water soluble Ash(%w/w)	5.5	3.6
4	Water soluble extractive value(%w/w)	12.6	20.3
5	Alcohol soluble extractive value (%w/w)	17.4	29.5
6	Moisture content (%w/w)	14.5	12

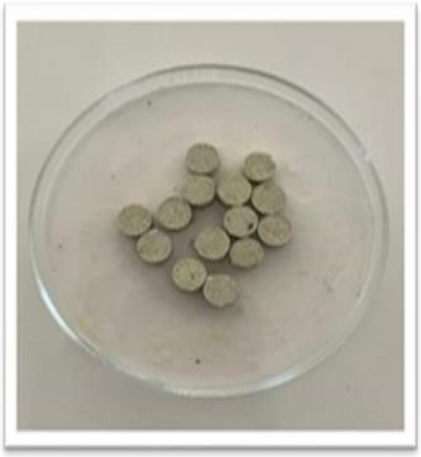
Phytochemicals present in ethanol and aqueous extracts of *Psydium guajava and Salvadora persic*

SL NO:	Chemical constituents	Psidium guajava		Salvadora persica	
		Water extract	Ethanol extract	Water extract	Ethanol extract
1	Alkaloids	+	+	-	+
2	Carbohydrates	+	-	+	+
3	Flavonoids	-	+	-	+
4	Saponins	+	+	+	-
5	Glycosides	-	-	+	+
6	Tannins	+	+	-	-
7	Phenols	-	+	+	+





Formulation Of Herbal Tooth Tablet



Evaluation of tooth tablet

Physical evaluation

The formulated herbal tooth tablet was visually inspected for their colour , state , shape and texture was determined.

SI NO	Specification	Observation
1	State	Solid
2	Colour	Pale green
3	Shape	Tablet shape
4	Texture	Hard&Brittle

Pre formulation studies

Formulation	Bulk density (g/ml)	Tapped density (g/ml)	Angle of repose	Hausner's ratio (g/ml)	compressibility	Percentage porosity
F1	0.509	0.634	35.65	1.164	19.71	5.95
F2	0.536	0.613	26.33	1.143	12.56	6.54
F3	0.615	0.674	24.23	1.095	8.75	12.01

Determination of angle of repose using Fixed funnel method

Post formulation studies

Formulation	Weight variation (g)	Hardness	Friability %	pH	Disintegration time	Foamability
F1	508	1.7	0.78	6.9	1min 50sec	28
F2	515	2.6	0.90	7.1	1min 42sec	52
F3	503	3.4	0.61	7.4	1min 42sec	72

Monsanto hardness tester Disintegration apparatus Friabilator pH meter

DISCUSSION

The present work is to develop tooth tablet contain herbal ingredients to applied in the treatment of tooth decay and to promote oral health. Continuous usage of synthetic agents containing tooth tablet causes various side effects such as altered taste, discolored teeth etc. In order to overcome these problems associated with synthetic agent herbal tooth tablet were considered as a better choice. There is a greater possibility in the development of herbal formulation as it is safe, effective, convenient, and economic. Tooth tablets being dry there is minimal preservatives, hence it is safe and eco friendly. Being in tablets form they are easy to transport. The main aim of the study is to make herbal tooth tablet by using herbal plants such as *Salvadora persica, Psidium guajava*. The plants were selected on the basis of their therapeutic potential, antimicrobial activity, selective therapeutic action on oral cavity and ease of availability. The leaves of *Psidium guajava*

collected from kasaragod district, Kerala in the month of October 2024,fresh bark of *Salvadora persica* were purchased from a local market. The plant materials are identified and authenticated by Dr. Sonia N S assistant professor of (horticulture) college of agriculture Padnekkad, Kasaragod, Kerala. The collected plant materials were carefully washed under running water followed by sterilized distilled water and dried under shade. The dried plant material were homogenized to a fine coarse powder and were subjected to maceration technique by using solvent ethanol. The extract obtained after the maceration was subjected for phytochemical analysis. By analysing the result obtained for preliminary phytochemical analysis, it was confirmed that the ethanolic extract of *Salvadora persica* was found to be rich in volatile oils, alkaloids, glycosides, saponins, flavonoids, minerals and the ethanolic extract of *Psidium guajava* was found to be rich in flavonoids, polyphenoles, essential oils, vitamin c, saponins. The literature survey and the phytochemical analysis conducted during the study reveals that the selected plants are rich source of important phytoconstituents and are able to exert excellent therapeutic activity. The physiochemical parameters like ash value, extractive value and moisture content was determined. Total ash value of *Salvadora persica* and *Psidium guajava* was found to be 6.8% , 8.25% and acid insoluble ash was found to 2.8%,6.3%, water soluble ash was found to be 5.5%, 3.6% , water soluble extractive value was found to be 12.6%, 20.3% , alcohol soluble extractive value was found to be 17.4%, 29.5%, and moisture content of *Salvadora persica* and *Psidium guajava* was found to be 14.5%, 12%.The higher water soluble extractive value indicates the presents of a greater number of water soluble contents in the plants. The herbal tooth tablet was formulated by using natural ingredients such as of clove oil,Guava and Miswak . Pharmaceutical dosage form is said to be incomplete without excipients. Natural ingredients were mixed with suitable detergent, preservative, sweatner, binder , lubricant , glidant,flavouring agent and abrasive. The developed formulation was further subjected to evaluation studies. The prepared herbal tooth tablet were examined by its pre compression evaluation such as angle of repose, flow rate, bulk density, tap density, carr's index, Hausner's ratio, and post compression evaluation involved hardness, Friability, foamability, pH. It was found that the formulation was light green in colour, characteristics odour. The pH of the herbal tooth tablet was found to be 7.4 which lies in alkaline pH range do not produce any irritation upon buccal cavity, and it complied with BIS limit. The hardness of herbal tooth tablet was good it have accurate hardness, it shows good foaming property. It was concluded that the developed herbal tooth tablet possess all the desirable properties of the ideal tooth tablet.

AKNOWLEDGEMENT

We earnestly reverse the Almighty for this boundless love and blessings, which A accompanied in all journey of our life. We therefore take this opportunity to express our deepest gratitude to those who have assisted us in completion of this thesis work. We are grateful to the Management of Rajiv Gandhi Institute of Pharmaceutical Sciences and Research, Trikaripur for supporting us throughout our dissertation period. With great respect we thank Dr. M Paridhavi, , M Pharm, PhD. , FABAP , Principal, Rajiv Gandhi Institute of Pharmaceutical Sciences and Research, for his academic support. We would like to gratefully thank Mrs. Sharanya R K , Assistant Professor, Dept. Of Pharmaceutics , Rajiv Gandhi Institute of Pharmaceutical Sciences and Research, Trikaripur, for providing sincere and valuable guidelines, also we would like to

express our sincere gratitude for being our guide and providing continuous support for our thesis and related research for her patience, motivation, understanding and her immense knowledge and friendship during our studies.

REFERENCES

1. Development And Evaluation Of Toothpaste Tablets For Dental Caries 1Jincy V Varghese, 2Rishikesh P, 3Sreelakshmi S, 4Ajay W, 5Rathul M A, 6Alwyn S Kumar.
2. Formulation and Evaluation of Effervescent Tooth Foaming Tablet Mirza Prince1*, Gopinath E2 Mediindia
3. Wi, Wan &Fathilah, Abdul & Abdul razak, Fathilah& Rahim, Zubaidah& Rahim, Abdul. (2013). oral microbes and its environment: a review article. Esteem academic journal. 9. 67-75
4. Fabbri G, Cannistraro G, Pulcini C, Sorrentino R. The full-mouth mock-up: a dynamic diagnostic approach (DDA) to test function and esthetics in complex rehabilitations with the increased vertical dimension of occlusion. Int J Esthet Dent. 2018; 13(4):460-474.
5. Dhage, Varsha &Chougule, Pratibha. (2019). Importance of Oral Hygiene in Oro-Dental Diseases: A Review Study. E-ISSN: 2349-9788; P-ISSN. 12. 8.Naseem, Sajida & Fatima, Syeda& Ghazanfar, Haider &Haq, Sana & Khan, Najeeb & Mehmood, Moeez& Ghazanfar, Ali. (2017). Oral Hygiene Practices and Teeth Cleaning Techniques Among Medical Students. Cureus.
6. .Deore, Nisha N., and R. K. Surawase. "A chewable toothpaste tablet: An alternative approach to the toothpaste.", 2022; 336-342.
7. Toothpaste Tablets: A New Way to Brush Your TeethBy: Jim Marion | Mar 29, 2019 https://health.howstuffworks.com/wellness/oral-care/products/toothpaste-tablets-new-way-to-brush- teeth.htm.
8. Powell RN. The relationship of forming and mature dental plaque to the tooth surface. J Dent Res. 1965;44:1171–5. [Google Scholar]
9. Maxwell SR. Prospects for the use of antioxidant therapies. Drugs. 1995;49:345–61. doi: 10.2165/00003495-199549030-00003.
10. Gupta GK, Chahal J, Arora D. Psidium guajava Linn.: Current research and future prospects. J Pharm Res. 2011;4:42–6.
11. Rishika D, Sharma R. An update of pharmacological activity of Psidium guajava in the management of various disorders. Al-Ayed et al., 2016
12. M.S.Z. Al-Ayed, A.M. Asaad, M.A. Qureshi, H.G. Attia, A.H. Al Marrani Antibacterial activity of Salvadora persica L. (Miswak) extracts against multidrug resistant bacterial clinical isolates.
13. Evid. Based Complement Alternat. Med. (2016), 10.1155/2016/7083964 Al-Bayaty et al., 2018
14. F.H. Al-Bayaty, W.I. Zaidi, M.N. Abdullah, O. Emad, M.M. Al-Obaidi Effect of Salvadora persica (Miswak) on alveolar bone healing after tooth extraction in rat J. Int. Dent. Med., 11 (3) (2018), pp. 770-777 Al-Bayaty et al., 2013
15. F.H. Al-Bayaty, A.A. Kamaruddin, M. Ismail, M.A. Abdulla Formulation and evaluation of a new biodegradable periodontal chip containing thymoquinone in a chitosan base for the management of chronic periodontitis J Nanomater, 2013 (2013), Article 397308
16. Dotiwala AK, Samra NS. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): April 19, 2021.Anatomy, Head and Neck, Tongue.
17. Editor(s): Bernad A Cohen, Pediatric Dermatology (Fourth Edition), W.B.Saunders,2013, Page viii,https://doi.org/10.1016/B978-0-7234-3655-3.00014-X.

18. Chaturvedi, Manav &Punj, Anahita. (2018). Human oral microflora. International Journal of Current Advanced Research. 7. 14065-14070. 10.24327/ijcar.2018.14070.2539.
19. Wi, Wan &Fathilah, Abdul & Abdul razak, Fathilah& Rahim, Zubaidah& Rahim, Abdul. (2013). Oral microbes and its environment: a review article. Esteem academic journal. 9. 67-75.
20. Britannica, the Editors of Encyclopedia. "Tooth". Encyclopedia Britannica, 19 Feb. 2021, https://www.britannica.com/science/tooth-anatomy. Accessed 1 October 2021.
21. American Dental Association: https://www.mouthhealthy.org/en/az-topics/t/tooth.
22. Fabbri G, Cannistraro G, Pulcini C, Sorrentino R. The full-mouth mock-up: a dynamic diagnostic approach (DDA) to test function and esthetics in complex rehabilitations with the increased vertical dimension of occlusion. Int J Esthet Dent. 2018; 13(4):460-474.
23. Dhage, Varsha &Chougule, Pratibha. (2019). Importance of Oral Hygiene in Oro-Dental Diseases: A Review Study. E-ISSN: 2349-9788; P-ISSN. 12.
24. Naseem, Sajida & Fatima, Syeda& Ghazanfar, Haider &Haq, Sana & Khan, Najeeb & Mehmood, Moeez& Ghazanfar, Ali. (2017). Oral Hygiene Practices and Teeth Cleaning Techniques Among Medical Students. Cureus. 9. 10.7759/cureus.1487.
25. Agrawal A, Gupta A (2020) Exploring the Factors Influencing the Choice of Oral Care Products: A Review on Personalized Approach. Int J Oral Dent Health 6:109. doi.org/10.23937/2469-5734/1510109
26. Zare, P. &Saeedi, Majid & Akbari, Jafar&Morteza-Semnani, Katayoun. (2017). A review on herbal oral care products. Journal of Mazandaran University of Medical Sciences. 26. 394-410.
27. Sekar, Mahendran. (2016). Formulation, Evaluation and Antibacterial Properties of Novel Polyherbal Toothpaste for Oral Care. International Journal of Pharmaceutical and Clinical Research. 8. 1155-1158.
28. Mude, Gaurav &Thombare, Ganesh. (2020). Formulation and evaluation of polyherbal toothpaste and comparative study with marketed formulations. 3796.
29. Shilpa PD, Priya VM, Prachi M.Preparation and evaluation of herbal tooth powder: World Journal of Pharmaceutical Research. 8(10):944-948.
30. Madan, Charu& Arora, Kapil & Chadha, Vandana & Manjunath, Bhadravathi& Chandra shekar, B R & Rani, Vatchala. (2014). A knowledge, attitude, and practices study regarding dental floss among dentists in India. Journal of Indian Society of Periodontology. 18. 361-8. 10.4103/0972-124X.134578.
31. Azcarate-Velázquez, Francisco & Garrido-Serrano, Roberto & Castillo-Dalí, Gabriel &Serrera-Figallo, Ma &Gañán-Calvo, Alfonso & Torres-Lagares, Daniel. (2017). Effectiveness of flossing loops in the control of the gingival health. Journal of Clinical and Experimental Dentistry. 9. 10.4317/jced.53858.
32. Majeed, Abdul & Farooq, Imran & Grobler, Sias& Rossouw, RJ. (2015). Tooth-Bleaching: A Review of the Efficacy and Adverse Effects of Various Tooth Whitening Products. Journal of the College of Physicians and Surgeons--Pakistan: JCPSP. 25.
33. Toothpaste Tablets: A New Way to Brush Your TeethBy: Jim Marion | Mar 29, 2019 https://health.howstuffworks.com/wellness/oral-care/products/toothpaste-tablets-new-way-to-brush- teeth.htm

34. Toothpaste tablets: Your next big thing by: Sudip Saha |May 25, 2021https://www.dentistryiq.com/dentistry/products/hygiene/article/14203936/toothpaste-tablets-your- next-big- thing
35. AtheerAwad, Sarah J. Trenfield, Abdul W. Basit, Chapter 19 - Solid oral dosage forms, Editor(s): AdeboyeAdejare, Remington (Twenty-third Edition), Academic Press,2021, Pages 333-358,
36. AshikaAdvankar, Rahul Maheshwari, VishakhaTambe, Pooja Todke, Nidhi Raval, Devesh Kapoor, Rakes K. Tekade, Chapter 13 - Specialized tablets: ancient history to modern developments, Editor(s): Rakesh K. Tekade, In Advances in Pharmaceutical Product Development and Research, Drug Delivery Systems, AcademicPress,2019, Pages 615-664.
37. Nurhidayah Md. H, Shuhaila H, Muhammad S, Rabiatul J, Tengku N, Zaidatul S, Optimization of guava chewable toothpastetablets, International Jasin Multimedia and Computer Science Invention and Innovation Exhibition. 2020; 148-150.
38. Deore Nisha N, Surawase RK. A Chewable Toothpaste Tablet: An Alternative approach to the Toothpaste. Research Journalof Pharmaceutical Dosage Forms and Technology. 2022;14(4):336-2.
39. Monika Sahebrao Tambe, Priyanka Pradeep Tandel, Manish Mukesh Vaishnav. A Review on Tooth Paste Tablet. International Journal of Research Publication and Reviews, 2023, Vol 4, no 4, pp 805-808
40. Patil PS, More AK, Kadam S, Vishwasrao V, Patel Y. Formulation and evaluation of orodispersible tablets of perindopril erbumine using natural superdisintegrant. Journal of Drug Delivery and Therapeutics. 2013 Sep 14;3(5):44-8.
41. G. Govinda Reddy, Naina R., N. Abhishek, Nasir M., Murugesh Roopashree a, Gopal Naik L. M. Formulation and evaluation of triclosan chewable toothpaste tablet. World journal of pharmacy and pharmaceutical sciences. Volume 12, Issue 11, 1189-1204
42. Brahmankar M, Jaiswal B, Biopharmaceutics and pharmacokinetics, A treaties. 1st edition. New Delhi. Vallabh Prakashan. 1995
43. Naveen Nagar (2024) Formulation and Evaluation of Floating Tablet of Isradipine Educational Administration: Theory a Practice, 30(5), 9250-9259
44. Patidar VK, Sharma A. Design, Formulation and evaluation of Amiodarone HCl co-crystal tablet. European Journal ofMolecular & Clinical Medicine. 2021;7(8):2020.
45. Indian Pharmacopeia, Government of India Ministry of Health and Family Welfare. The Controller of Publications. Delhi. 2007; 2: 550,746.
46. ICH Harmonized Tripartite Guidelines, Stability Testing of New Drug Substances and Products. ICH Committee; 2003.
47. The Indian Pharmacopoeia, Government of India, Ministry of Health and Family Welfare, Published by The Indian Pharmacopoeia Commission Ghaziabad.247,947,1452,2371
48. https://www.researchgate.net/publication/344071657_An_Alternative_Approach_to_Waste_Manageme nt _A_Study_on_Toothpaste
49. Asha M. Jagtap, Sudhir R. Kaulage, Shivam S. Kanse, Vishal D. Shelke, Akshata S. Gavade, Ganesh B. Vambhurkar, Rohit R. Todkar, Vidya N. Dange. Preparation and Evaluation of Toothpaste. Asian J. Pharm. Ana. 2018
50. ManupatiPrasanth, SatyaNarayanaRatha, Antimicrobial Property of Herbal Toothpastes: An In-Vitro Analysis. Research Journal of Pharmacology and Pharmacodynamics. 2014.
51. Sure P. B., Band K. S., Ingole A. R., Baheti J. R. Formulation and Evaluation of Chewable

Tablets of Anti- Asthmatic Drug. Research Journal of Pharmacy and Technology. 2022

52. A Review on Tooth Paste TabletMonika SahebraoTambe, PriyankaPradeepTandel,Manish MukeshVaishnav International Journal of Research Publication and Reviews, Vol 4, no 4, pp 805-808 April 2023.
53. A Comparative Life Cycle Assessment of Toothpaste Cream versusToothpaste TabletsSuphichayaSuppipat , Allen H. Hu , Lien T.K. Trinh ,Chien-Hung Kuo , Lance Hongwei Huang International Journal Of Pharma Professional's Research Tooth Tablets: A
54. Review of Formulation ConsiderationAnkita. J. Patel*, Jaivin. V. Chauhan Volume – 14, Issue – 4,October – 2023
55. A Chewable Toothpaste Tablet:An Alternative approach to the Toothpaste DeoreNisha N., R. K. Surawase.
56. A Comprehensive Review of Chewable Toothpaste Tablet Prof. Govind Reddy*, Dr.
57. K. M. Manjanna, Murugesh Roopashree, Nayana, Abhi Gowda, Gopal Naik World Journal of Pharmacy And pharmaceutical Sciences.

HOW TO CITE: Khadeeja P.*, Haseeba Palakkodan, Mubashira P., Reema Abdul Latheef, Sreya C. V., Sharanya R. K., Formulation and Evaluation of Herbal Tooth Tablet, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 6, 2889-2904. https://doi.org/10.5281/zenodo.15709191