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Review Article

To Formulate And Evaluate Herbal Toothpaste

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ABSTRACT

Toothpaste is a paste or gel to be used with a toothbrush to maintain and improve oral health and aesthetics. Since their introduction several thousand years ago, toothpaste formulations have evolved considerably - from suspensions of crushed egg shells or ashes to complex formulations with often more than 20 ingredients. Among these can be compounds to combat dental caries, gum disease, malodor, calculus, erosion and dentin hypersensitivity. Furthermore, toothpastes contain abrasives to clean and whiten teeth, flavors for the purpose of breath freshening and dyes for better visual appeal. Effective toothpastes are those that are formulated for maximum bioavailability of their actives. This, however, can be challenging as compromises will have to be made when several different actives are formulated in one phase. Toothpaste development is by no means complete as many challenges and especially the poor oral substantivity of most active ingredients are yet to overcome.

INTRODUCTION

Introducing a herbal toothpaste represents a paradigm shift in oral care, capitalizing on the growing consumer preference for natural and sustainable products. This herbal alternative aims to revolutionize traditional dental hygiene by incorporating time-tested botanical ingredients renowned for their oral health benefits. Herbal toothpaste distinguishes itself from conventional options through the exclusion of synthetic chemicals and the utilization of plant-derived components. Ingredients like neem, clove, and peppermint offer antibacterial properties, promoting gum health and preventing cavities. The absence of harsh chemicals aligns with the rising demand for products that are not only effective but also gentle on both oral health and the environment. In addition to its oral health benefits, the herbal toothpaste addresses the increasing consumer awareness of sustainability. The incorporation of biodegradable packaging and eco-friendly manufacturing processes underscores a commitment to reducing the ecological footprint associated with oral care products.

Consumer preferences are shifting towards holistic well-being, prompting the exploration of herbal

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alternatives. The herbal toothpaste not only targets oral health but also taps into the broader wellness trend. The inclusion of herbal extracts known for their calming or revitalizing properties provides a unique selling proposition, catering to consumers seeking a more holistic approach to self-care. To evaluate the effectiveness of the herbal toothpaste, rigorous clinical trials and consumer studies are essential. Comparative studies against traditional toothpaste formulations can establish its efficacy in preventing cavities, reducing plaque, and promoting gum health. Consumer feedback on factors such as taste, texture, and overall satisfaction is critical to gauging market acceptance. Marketing strategies should emphasize the product's natural origins, highlighting the benefits of each herbal ingredient. Collaborations with oral health professionals can lend credibility and provide endorsements, fostering trust among consumers. Educational campaigns on the advantages of herbal toothpaste over conventional options can further elevate awareness and drive adoption. However, challenges may arise in market penetration, given the established dominance of mainstream toothpaste brands. Overcoming skepticism and building trust in the efficacy of herbal alternatives requires strategic marketing campaigns and partnerships with reputable retailers. Pricing strategies should strike a balance between affordability and the perceived value of natural ingredients. In conclusion, the introduction of a herbal toothpaste represents a forward-looking approach to oral care, aligning with evolving consumer preferences for natural, sustainable, and holistic products. Successful implementation requires a comprehensive marketing strategy, robust scientific validation, and a commitment to environmental responsibility. By addressing both oral health needs and broader wellness trends, the herbal toothpaste has the potential to carve out a significant niche in the competitive oral care market.

IDEAL PROPERTIES OF HERBAL TOOTHPASTE:-

1. It should not be haemful to the oral tissue & fluid
2. It should not strain teeth
3. It shoul note be harmful to the g.i.t
4. It should have pleasant odour &taste

BENEFITS OF HERBAL TOOTHPASTE:-

1. To remove dental plaque
2. To stimulate apprtit to provide a sense of well being
3. To maintaine the healthy state of mouth, gums, teeth and gums

METHOD OF FORMULATION AND MATERIAL REQUREMENT :-

PRINCIPLE:-

Research various herbs known for dental benefits (e.g., neem, clove, peppermint).

Select herbs based on their antimicrobial and dental health properties.

Ingredients and Proportions:

Determine the proportions of selected herbs and other key ingredients (like baking soda or xylitol).

Consider texture, flavor, and consistency for user satisfaction.

Base and Binding Agents:

Choose a base (often a gel or paste) that accommodates herbal components.

Select binding agents like glycerin or xanthan gum for stability.

Extraction Methods:

Decide on extraction methods (e.g., infusion, decoction) for herbal properties.

Ensure that the extraction process maintains the efficacy of the herbs.

Testing for Effectiveness:

Design an appealing packaging that communicates the herbal and dental health aspects.

Ensure that the packaging maintains the product's integrity.

User Feedback:

Gather feedback from users on the effectiveness and user experience. Make necessary adjustments based on user input. Remember to consult with experts in herbal medicine, dentistry, and formulation to create a well-balanced and effective herbal toothpaste.

Fig 1: TOOTHPASTE

Experimental Work Equipment :-

Digital balance, PH meter, measuring cylinder, glass bowl, spoon, brooke filed viscometer, porcelain dish, glass rod, water bath, beaker.

Preparation before the formulation:-

Clean and sanitize your work area and all you packaging material. It is suggested that you wear glove, protective clothing and a hair net while preparing this recipe.

COMPOSITION

Sr no.	Ingredient	Quantity
1	Tulsi	2gm
2	Camphor	1gm
3	Babool leaves	5gm
4	Triphala leaves	1gm
5	Clove powder	1gm
6	Cinnamon powder	1gm
7	Amrud leaves	2gm

FORMULATION METHOD OF TOOTHPASTE:-

PROCEDURE:-

All herbal ingredients were dried and grounded using domestic mixer or pestle and mortar.

Gm of tulsi powder, 1gm of camphor ,5gm of Acacia arabica, 1gm of Triphala powder ,1gm clove powder, 1gm of cinnamon powder ,2gm of Amrude leaves powder ,are weight and taken in mortar. Then 30gm of calcium carbonate added as abrasive, 1gm of sodium lauryl sulphate are use as detergent and foaming agent and honey are added as sweetening agent ,glycerin was added as humectant and 0.5 gm of tragacanth are added as binder these all chemicals mix in water .This solution was added drop wise into mortar ,containing all herbal ingredients. Then triturated well ,until a paste consistency is form .

Ingredient	Biological name	Uses
	Ocimum sanctum	Anti- bacterial

	Cinnamomum camphora	Ant septic
	Gum Arabic tree (vachellia nilotica)	Astrigent
	Emblica officinalis	Antimicrobial
	Syzygiumaromaticum (Myrataceae)	Dental analgesic
	Cinnamonum zeylanicum (Myraraceae)	Flavoring agent

	Psidumguajava (myrtaceae)	Antimicrobial

INGREDIENTS USED IN HERBAL TOOTHPASTE :-

Tulsi :-

Tulsi is a holy plant that has both medicinal and spiritual properties. In Ayurveda, it is known by different names such as "Mother Medicine of Nature" and "The Queen of Herbs".Tulsi is beneficial in relieving cough and cold symptoms due to its antimicrobial, anti-inflammatory, antitussive (cough-relieving) and anti-allergic properties. Taking a few leaves of Tulsi along with honey helps relieve cough and flu as it improves immune health. Taking Tulsi tea on a daily basis has a calming effect and helps reduce stress. According to Ayurveda, Tulsi helps reduce asthmatic symptoms due to its Kapha-balancing property.Tulsi is also useful in managing ringworm infection. Applying a paste of Tulsi leaves on the affected area helps prevent infection and also relieves inflammation as well as pain.

Fig 2: TULSI

Camphor :-

Camphor is a powder that originally came from the bark and wood of the camphor tree. Today, most camphor is synthetic. It's in some products that are applied to the skin, including FDA-approved treatments. It's a common ingredient in remedies applied to the skin for cough and skin irritation.

Its antiseptic properties help relieve toothache and freshen breath.In ayurveda it is described in diseases like Danta Puya i.e. Pyorrhoea, and Danta Sula i.e Toothache. Camphor helps in managing toothache and gum diseases due to its anti-inflammatory property. It helps reduce pain and inflammation in the tooth. It also prevents the growth of bacteria in gums and teeth[10]. Camphor helps to reduce toothache and also control bleeding from gums when applied on the affected area.

Fig 3 : CAMPHOR

Babool leaves :-

Babul extract (Acacia Arabica) present in Dabur Babool has been long known to help keep your gums healthy and teeth strong naturally. Clove, the powerful natural ingredient, has been used for years to protect teeth from cavities and relieve denta. Babool is helpful in managing teeth disorders like plaque formation, gingivitis etc. It is because Babool consist of tannins and gallic acid which have antibacterial, antihistaminic, anti-inflammatory, haemostatic and astringent

properties that helps to manage tooth infections and inflammations.

Fig 4 : BABOOL LEAVES

Triphala powder :-

Toothpaste: Mix triphala churna with a small amount of water to form a thick paste and use it as you would use any toothpaste. As mouthwash: Mix a half teaspoon of Triphala powder with half a cup of warm water. Use it as you would use any mouthwash. Triphala's astringent properties help prevent issues like gum bleeding. Miswak is loaded with anti-inflammatory benefits, and Neem provides antioxidant properties which help protect the gums and teeth. Apply a little powder on the tooth brush and start brushing. Mouth will start producing excessive mucus which is a normal cleansing action.It will taste worse than any of the tooth pastes but oral health benefits will be much greater.

Fig 5 : Triphala powder

Clove powder :-

Cloves contain a strong anaesthetic known as eugenol which similarly works as an antiseptic to fight bacteria that may cause infections. That is why cloves are so effective at fighting cavities and are often added to oral products such as toothpaste and mouthwash. Clove reduces swelling in gums as it carries anti-inflammatory properties. Clove enhances gum tissue health by stimulating circulation & protects your teeth against acid attack by adding vital minerals to the enamel of the teeth. Clove toothpastes are made with scientifically proven, high quality ingredients. Clove oil contains eugenol, a chemical that acts as an anesthetic and antibacterial agent. It may be an effective treatment for toothache or tooth pain. Eugenol, a chemical found in cloves, has been used in dentistry since the 19th century. Cloves and clove oil have long been used as a home remedy for a toothache.

Fig 6: Clove powder

Cinnamon powder :-

Cinnamon contains calcium that helps you maintain healthy teeth. Just a tablespoon can offer almost 80mg of calcium. Flavonoids in cinnamon can fight inflammation, reducing swelling and helping tooth pain. It also helps to soothe tender gums, especially in teething infants. It cleans and increases the shine of your teeth. In addition to its sweet taste, Cinnamon powder is also an excellent antimicrobial. There is a great deal of evidence, both historical and new that supports the benefits of cinnamon in oral care. As such, it was a natural choice for a natural toothpaste. It's naturally rich and strong flavour is so beautifully blended with our mixture of essential oils that it isn't overpowering to use.

Fig 7 : Cinnamon powder

Amrud leaves :-

Guava is considered as poor man's apple rich in phytochemicals with medicinal value and hence it is highly consumed. Gas chromatography–mass spectroscopy (GC–MS) analysis of guava leaf extract revealed the presence of various bioactive compounds with antimicrobial, antioxidant, anticancer, and antitumor properties. Hence, it is used in tooth paste formulations along with other ingredients such as Acacia arabica gum powder, stevia herb powder, sea salt, extra virgin coconut oil, peppermint oil in the present study. Three formulations F1, F2 and F3 have been made by varying the concentration of these ingredients and the prepared formulations were studied for their antimicrobial activity and physico-chemical parameters such as pH, abrasiveness, foaming activity, spreading and cleaning ability. Among these, F3 showed significant antioxidant and antimicrobial properties, minimal cytotoxicity, maximum spreadability and very high cleaning ability. This study surmises that the herbal toothpaste formulation is greener, rich in medicinal values and imparts oral hygiene.

Fig 8 ; Amrud leaves

EVALUATION PARAMETERS OF HERBAL TOOTHPASTE :-

Physical examination :-

Abrasives

Abrasives are the substances that are used for abrading, grinding or polishing. They remove substances adhering to the surface of the teeth without scratching it and bring out their natural luster. One of the mayor properties of the abrasive is hardness. The degree of abrasivity depends on the hardness of the abrasive, the morphology of the particles, and on the concentration of abrasive in the paste. As the hardness of the enamel on the tooth surface is 6-7 on the Moh's scale, the hardness of an abrasive should be 3 or less. For practical purposes, the particle size should be 20μm or less; if it is more than this they may damage the tooth surface and gums. The abrasives found in toothpastes are often not as hard as the enamel, but as hard or harder than the dentine. Abrasives are most often found as crystals, small and smooth particles are preferred to avoid tooth wear. Needie and rod-shaped particles must be avoided (2). Although many methods have been suggested for measuring the abrasive effect powders incorporated in toothpastes, the RDA method (Radioactive Dentine Abrasion) is the most widely accepted in the world today. In this method, an extracted human tooth is irradiated to convert the 31P in its dentine to 32p. The tooth is then put into an abrasion testing machine together with an abrasive and the abrasion of 32p is measured using a radioactivity counter. The pH of abrasives should range from weakly acidic to weakly alkaline and they should be white powders which are insoluble in water, flavourless and odourless. The following substances are widely used abrasives, which satisfy these conditions:

Calcium carbonate (CaCO3) A fine, white, odourless, microcrystalline powder, practically insoluble in water (3). This abrasive has been used for a very long time. Its abrasiveness is generally

higher than that of calcium phosphate. There are two types-a heavy and precipitated type. The raw material for the former is limestone and for the latter calcium hydroxide. Calcium phosphate, dibasic; Calcium phosphate, dibasic, dihydrate (CaHPO4, CaHPO4x 2H20) There is a dihydrate form and an anhydride form. As the anhydride form is harder than the dihydrate form, it is not often used by itself. The dihydrate form has a mild abrasive effect and feels good on use. It is neutral in pH and has good compatibility with other ingredients. However, when it is in toothpaste for a long period of time, it loses its water of crystallisation, changes to the anhydride form and makes the toothpaste go hard. For this reason a magnesium salt or other stabiliser is added (2).

Silica, silica hydrate (SiO2, SiO2 x nH2O)

The main ingredient of the silica used in abrasives is high purity amorphous silicon dioxide and there are varieties of different types whose properties vary with the method of production. Silica is very suitable for use in toothpastes containing fluoride because no insoluble salt is formed when it reacts with fluoride. As its refractive index is lower than that of other abrasives, silica can be used to make clear gel tootpastes.

Other abrasives

Aluminium hydroxide is also used as an alternative to calcium phosphate, dibasic, because it is cheaper. Other abrasives such as calcium pyrophosphate, insoluble sodium metaphosphate, magnesium carbonate and alumna may also be used for special types.

Binders

Binders are used to prevent the separation of powder and liquid ingredients and give an appropriate degree of viscoelasticity and form to the toothpaste. They can prevent the toothpaste from drying out by binding water. Also, they have an influence on the dispersion, foaming, rinsing and other qualities of the toothpaste in the oral cavity. The most widely used binder at present is sodium carboxym-ethylcellulose (CMC). Carboxymethylcellulose is physiologically inactive, it dissolves in water, it is very compatible with other ingredients, highly stable and relatively low in price. There are many types of CMC having a variety of different characteristics stemming from different degrees of hydroxy group substitution and polymerisation, so it is necessary to select the most appropriate one for the purpose in mind. Other known cellulose derivatives include methylcellulose, hydroxyethylcellulose and hydroxypropylcellulose. Examples of other binders used are polysaccharides such as sodium alginate, carrageenan and xanthan gum; synthetic polymers like sodium polyacrylate and inorganic clay minerals as bentonite and laponite.

Sodium alginate

It is obtained from algae belonging to the Phaeophyceae, mainly species of Laminaria (4). It consists chiefly of the sodium salt of alginic acid. A white or pale yellowish-white powder which is odourless or almost odourless and tasteless. Slowly soluble in water, forming a viscous, colloidal solution; practically insoluble in alcohol and in ether. Sodium alginate has little surface activity and its emulsifying power is achieved by increasing the viscosity of the aqueous phase. It is used as a suspending and thickening agent and in the preparation of water-miscible pastes, creams and gels. According to the viscosity required, from 1 to 10 % is used in the preparation of pastes and creams.

Carrageenan

A dried aqueous extract from species of Chondras, Gigartina, Eucheuma or other members of the families Gigarti-naceae, Solieriaceae, Hypneaceae and Furcellariaceae. A white to yellowish coarse or fine, almost odourless powder with a mucilaginous taste. Soluble 1 in 100 of water at 85°c. It disperses more readily if first mixed with alcohol. It is used as an emulsifying, suspending and thickening agent in formulations of

toothpastes, creams and emulsions. Carrageenans are galactans or polymers of D-galactose, are heavily sulfated, and are anions with multiple electrolytes of molecular weight ranging from 105 to 106. All carrageenans have a linear structure of (AB)n type, with alternating 1,3 and 1,4 bonds. Classically, seven types of carrageenans are distinguished as a function of the nature of the sequence. These are t, κ, λ, μ, ν, θ, ξ carrageenans (5).

Carbomers

These are synthetic high molecular weight polymers of acrylic acid cross-linked with polyalkenyl ethers of sugars or polyalcohols. They are produced in several grades characterised by the viscosity of a defined solution. White, hygroscopic powders with a slight characteristic odour. They swell in water and in other polar solvents after dispersion and neutralisation with sodium hydroxide solution (6). It also soluble in water, alcohol and glycerol. Carbomer is used in toothpastes as a binder (thickener).

Xanthan gum

Xanthomonas campestris is a bacterium which commonly develops on certain species of Brassicaceae where, by using the vegetable substrate, it produces a gummy exudate: xanthan "gum", a high-molecular-mass anionic polysaccharide. It exists as the sodium, potassium or calcium salt (6). Industrially, this "gum" is produced by a bacterial culture on correctly buffered and aerated media containing carbohydrates with Xanthomonas campestris. Upon completion of fermentation, the polymer is recovered by precipitation with isopropanol, filtered, dried, and crushed (7). It is a cream-coloured powder. Soluble in hot and cold water, xanthan gum forms aqueous solutions of which the viscosity remains practically unchanged by temperature changes, as well as pH changes. The behaviour of these solutions is of the pseudoplastic-type: decrease in viscosity proportional to shearing and instant recovery of the initial viscosity upon discontinuation of shearing. Incompatibilities are rare (borates, hypochlorites, peroxydes, free radical generators). The gum is compatible with most salts, with moderate surfactant concentrations, and with most preservatives; it tolerates alcohol concentrations up to 50% percents. Compatible with most vegetable hydrocolloids, it does not form gels by itself, but it forms thermally reversible gels. It is devoid of toxicity. Xanthan gum is used as a stabiliser, binder (thickener), and emulsifier.

Humectants

They prevent loss of water, and subsequent hardening of the paste in the tube or when it is exposed to air. They also provide creamy texture. These are short-chained polyalcohols such as glycerol, sorbitol (highly concentrated aqueous solution), propylene glycol and polyethylene glycol.

Solvents

Water is the most common solvent used in toothpaste. It dissolves the ingredients and allows them to be mixed. Alcohol is used in mouth rinses (mouthwashes) as a solvent and taste enhancer.

Foaming agents

The functions of foaming agents are to disperse the toothpaste throughout the oral cavity in order to enhance the cleaning effect and, acting as a surfactant, clean away the dirt inside it. Also, by means of their volume of foam, they give a feeling of thickness, and satisfaction. Surfactants having excellent foaming, dispersion, suspension, permeation, cleansing and hard water resistance qualities as well as no toxicity or irritation, are selected for foaming agents. Surfactants lower the surface tension of the liquid environment in the oral cavity so that the substances in the toothpaste/mouthwash can contact the teeth more easily. They penetrate and dissolve plaque. This makes it easier to clean the teeth. The foaming effect produced by the surfactants is also

beneficial in cleaning the teeth, and contributes to remove debris and gives a feeling of cleanness. Another function of the surfactant is in dispersing the flavours in the toothpaste/mouthwash. Because, they go into the mouth, attention is also paid to taste and smell. The one most frequently used at present is sodium lauryl sulfate; other examples are sodium lauryl sarcosinate, sodium alkylsulfo succinate, sodium cocomonoglyceride sulfonate and sucrose fatty acid esters.

Sodium lauryl sulphate (SLS)

A mixture of sodium alkyl sulphates, consisting mainly of sodium dodecyl sulphate. It is a white or pale yellow powder or crystals with a slight characteristic odour. Freely soluble in water; partly soluble in alcohol (6). It exhibits high affinity for proteins and is a strong denaturing agent. Incompatible with cationic materials and with acids below pH 2.5. Sodium lauryl sulphate may be irritant to the skin and mucosa. It may also damage the mucosal mucin layer by denaturing its glycoproteins (8). The epithelium will then be more exposed for irritants and this can result in aphtous ulcerations in some patients. It has also been claimed that there is a connection between the use of toothpaste or mouthwash containing SLS and an increased frequency of recurrent aphthous ulcers (RAU) in some patients. A product without SLS may thus be recommended for patients with RAU (8). The adverse effects of SLS have resulted in the development of toothpaste and mouthwashes with alternative surfactants such as sodium lauryl sarcosinate, socamidopopybetaine. Common for these surfactants are that they are less irritating to the oral mucosa. It is effective in both acid and alkaline solution and in hard water. Also, it has antimicrobial activity due to its ability to interfere with membranes and a variety of biologic processes in microorganisms.

Flavouring agents

They get rid of the unpleasant smell and taste of the other raw materials and give a cold, refreshing taste. Combinations of water-insoluble essential oils, such as spearmint, peppermint, eucalyptus and menthol are often used as flavouring agents in toothpastes and mouthwashes. The flavouring agents are solubilised and dispersed through the paste or liquid via the surfactant.

Sweeteners

Sweeteners also improve the taste of toothpastes and mouthwashes and give them a mild and sweet taste. The most common used sweeteners are sodium saccharin, sorbitol and glycerol. Xylitol is a sweetener that is also claimed to provide anti-caries activity.

Colouring agents

Most toothpastes and mouthwashes contain colour-substances which give them an attractive appearance. The colour-substances are classified by the Colour Index (CI), published by the Society of Dyers and Colourists and the American Association of Textile Chemists and Colourists, or by a system called the FD&C Colours. Titanium dioxide is often added to toothpastes to give them a white colour.

Preservatives

Preservatives prevent the growth of micro-organisms in toothpastes and mouthwashes. Mostly, they include sodium benzoate, methylparaben and ethylparaben.

Pharmaceutical agents One or more therapeutic agents are usually added to toothpastes and mouthwashes. Most toothpastes today contain fluorides to prevent caries. Recently there has been a development of different toothpastes with additional purposes, such as stain and calculus removal, and prevention of gingivitis, sensitive teeth and gum problems. In the following text the different pharmaceutical therapeutic agents are categorised according to their claimed ef-feet.

ADVANTAGES OF HERBAL TOOTHPASTE

1. These help to eliminate bacteria and keep our mouth healthy.
2. While it seems that natural and herbal toothpastes are safe, choosing a conventional brand of toothpastes means that there are added benefits and agents helping to reduce or prevent your risk of dental disease.
3. Contains fluoride for protection against cavities.
4. Easy to use.
5. Whitening agent

CONCLUSION

In order to achieve the multi-claim products required for the dental care category, it is necessary for the formulator to use a variety of different ingredients. This places a number of demands on the development process. Innovations in the areas of pharmaceutical technology have contributed to the formulation of the products having superior efficacy as well as other attributes that may contribute to clinical response and patient acceptability. Improved clinical efficacy and tolerability, along with conditioning signals, should encourage patient compliance with oral hygiene further complementing professional efforts directed at disease prevention.

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