

Formulation and evaluation of herbal tooth powder for oral care

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ABSTRACT

Herbal tooth powders consisting of various ingredients that are available in the market in a wide range. Hence modern methods focusing on these aspects are useful for the standardization of herbs and their formulations. Consumers believed by using herbal-based toothpowders are safe, effective, and less toxic. This study is thus aimed to provide an alternative to the consumer and formulate herbal tooth powder using Clove, Neem Stem, Acacia Stem, Stevia Leaf, Mustard Oil, Salt, Ginger and Amla. The oral cavity infections are the most common types of infections. Dental caries is an infectious disease, causes damage and infection of enamel and dentine. If it is not treated, the infection continues and will lead to tooth loss. The mouth contains normal flora of opportunistic bacteria that are normally non-pathogenic. The imbalance of this situation causes infection and tooth decay. Streptococcus mutants are considered as the main species involved in the development of dental caries. S. mutants, acid-producing bacteria, causes fermentation of carbohydrates which results in tooth decay. Therefore, in the present work, the following aspects of Herbal tooth powders were planned for the formulation, standardization of herbal tooth powder, and anti-bacterial screening of the extracts of herbal tooth powder.



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INTRODUCTION

Oral hygiene is an important key to uphold good appearance, thought of an individual and gives confidence. The tooth consists of two parts, the crown, and the root. The crown of the tooth is covered by an outer surface called enamel and it is the hardest tissue in the tooth. The major composition of enamel is hydroxylapatite other than that it consists of water and keratin [1] Dentine is the under part of

the enamel, which is a composite of hydroxylapatite. It also consists of 70% of the collagen water. Fluorine is the major constituent of dentine. Oral consists of not only tooth but also saliva for easy to consume the food. Saliva is the major element proposed for lubricate the food and to maintain an appropriate environment in the mouth. Saliva is formed by various glands such as Labial, lingual, buccal, and palatal are the larger and smaller glands that produce saliva continuously to keep the tooth environment in the dynamic state [2]. Proteins, enzymes, bacteria, and mucin - polysaccharide are there in the saliva and inorganic materials like calcium, sodium, potassium, chloride, phosphate ions, etc.

The plaque, calculus, periodontal diseases are the major issues related to the tooth. It is mainly caused by bacterial action and mineralized deposition leads to calculus. These diseases are mainly due to the negligence in good caring of the tooth, so it can be prevented and controlled by proper brushing by

using effective toothpaste and tooth powders [3]. Dentifrice can be used as a prophylactic cosmetic for the tooth to avoid tooth decay and bad breath. Dentifrice can be prepared by synthetic and herbal ingredients nowadays herbal formulation is high in demand due to its effectiveness, to avoid the side effects when compared with synthetic formulations. Toothpaste and tooth powders are based on its abrasive property, the paste and powder apply on the tooth to rub against the tooth which helps to eliminate the deposited food debris and minerals from tooth [4]. "Oral health is essential to good health and quality of life." - WHO fact sheet on oral health, 2012 [5].

All these facts drag our attention towards our traditional system of medicines Ayurvedh, which mentions many herbal as well as mineral drugs which are known to be effective in oral hygiene. Natural remedies are more acceptable in the belief that they are safer with fewer side effects than the synthetic ones [6].

Despite the efficiency of many toothpaste formulations with antibacterial properties, there is a rising societal want to rely on naturally occurring compounds for health care, Ayurvedh has mentioned many such herbs which have an insightful effect on oral hygiene and have also brought into being their way into dentistry.

Tooth powders are more admired in suburban and rural areas. The constituents of tooth powder and toothpaste are the same except that tooth powders do not contain a humectant, water, and binding agents. The primary function of tooth powder is the cleaning of the available surfaces.

Herbal tooth powder has been about for centuries and many believe it to be an essential part of any teeth-cleaning regimen. Natural products have been recently investigated more thoroughly as promising agents for the prevention of oral diseases, especially plaque-related diseases such as dental caries due to side effects of the use of some hazardous chemicals in the most of the marketed toothpaste and powders which has created alarming situation, especially amongst the children.

A formulation containing natural ingredients is more acceptable and then synthetic drugs in the belief that they are safer. The objective of the present research work to formulate herbal tooth powder containing natural ingredients like Neem stem and bark, Acacia stem, Mentha leaves, Ginger, etc. which were by tradition used for tooth cleaning.

In the present study herbal tooth powder was formulated and evaluated for its Organoleptic and

physical properties such as Color, Odor, Taste, pH, Spread ability, Moisture content, Flow property, Foamability, etc. as per standards specified by Bureau of Indian Standards.

Ideal properties

- Good abrasive effect
- Non -irritant and non -toxic
- Impart no stain in tooth
- Keep the mouth fresh and clean
- Prolonged effect
- Cheap and easily available

MATERIALS AND METHODS

All drugs were collected from the local market. The Standardized herbal materials were dried under shade and tested for their moisture content until it came below six percent and tested for their standards according to Ayurvedic Pharmacopoeia of India. The materials were powdered and used for the formulation of Herbal tooth powder. The powdered herbal materials were sieved through a mesh size 85. The composition of the developed formulation is summarized in the table (Table 1).

Table 1: Composition of Herbal Tooth Powder

Ingredients	Quantity(gm)
Clove	18
Ginger	9
Amla	19
Neem bark	10
Acacia bark	20
Mentha leaf	6
Mustard oil	q.s
Salt	10
Stevia leaf	8

Determination of pH

Take 10gm of tooth powder in 150 ml beaker. Add 10 ml of freshly boiled & cooled water (at 27°C). Stir well to make a thorough suspension. Determine the pH of the suspension within 5 minutes using pH meter [7].

Determination of Foaming Power

The product was evaluated for foam ability by taking a small amount of preparation with water in a measuring cylinder initial volume was noted and then

shake and for 10 times. The final volume of foam was noted.

Foaming power = V1 – V2

V1 - Volume in ml of foam with water

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 (8)

$$\% \text{ Moisture content} = \frac{\text{Original sample weight} - \text{Dry sample weight}}{\text{Original sample weight}} \times 100$$

Determination of Spreadability

About 1gm of the sample was weighed and placed at the center of the glass plate (10X10 cm) and another glass plate was placed over it suspiciously. Above the glass plates, 2 -kilogram weight was placed at the center of the plate to avoid sliding of the plate. The diameter of the paste in centimeters was measured, after 30 minutes for all samples. The experiment was repeated three times and the averages were reported for all samples [8].

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.

Bulk density = Untapped density – tapped density

ORGANOLEPTIC CHARACTERS

The sample was evaluated for organoleptic characters using parameters like appearance, color, odor and taste [9].

Flow Property

The angle of repose is a term used to measure the maximum angle, upwards from the horizontal, at which a pile of a particular granular material will remain stable without any of the material sliding downward. It is useful in designing storage and transportation machinery for granular material as it can give an engineering insight into an appropriate size and shape of search devices (Table 5).

$$\theta = \tan^{-1} h/r$$

Anti- Bacterial Activity

In-vitro anti-bacterial activity

In-vitro antibacterial activity of all the four extracts was evaluated by using the agar well diffusion method.

Agar well diffusion method

Preparation of Agar media

Suspended 9.5gm MHA agar in a 500ml conical flask and 250ml distilled water was added. Then, it was heated on a hot plate with frequent agitation until it completely dissolved. Then, the media was sterilized in an autoclave at 121°C for 1 hour.

Approximately 25ml of Mueller-Hinton Agar (MHA) was poured into a sterile petri- dish and allowed to solidify. 50µl of bacterial inoculums was spread on the solidify MHA media by using the sterile spreader. In each of these plates, two wells (5mm diameter) were punched into the agar by using a sterile cork borer. Then, the working concentration of 100mg, 150mg, 200mg, and 250mg dilution were prepared from 500mg/ml of stock solution of each extract, and 150µl of each extract was separately added into wells and allowed to diffuse at room temperature. An equal volume of alcohol was used as a negative control and standard antibiotic (Erythromycin) was used as a positive control. The plates were incubated for 24hours at 37°C and the diameter (in mm) of a clear zone of growth inhibition was recorded and measured with the help of radius scale [10].

RESULTS AND DISCUSSION

In the present study formulated and evaluated Herbal tooth powder. The organoleptic property showed a brown color slight odor with a sweet taste. The foaming power of the tooth powder was found to be 0.9ml. The moisture content of the powder shows 1.06%. The powder has 8gm/ml of bulk density. The angle of repose was determined to find out the flow property and it shows good flow property. The pH of the formulation was found to be 6. The results of the sample were shown in Table 2. The anti-bacterial activity of the tooth powder extracts of *E.coli* and streptococcus aureus was shown in Tables 3 and 4.

Dental caries are the most common oral infectious disease among children and old age. The prevention strategy against dental caries includes the elimination of carcinogenic microorganisms from the oral cavity, inhibition of their plaque formation, and the enhancement of tooth resistance to demineralization. In the former strategies, phytochemicals have been widely studied for their antimi-

crobial activity. A variety of plants with potent activity are known to be traditionally used for dental hygiene world-wide. Antibiotics and other antimicrobial agents are effective in the prevention and treatment of dental caries, but they also, cause

Table 2: Evaluation of Herbal Tooth Powder

S.No	Parameter	Observation
1.	pH	6
2.	Foaming power	0.9 ml
3.	Moisture content	1.06
4.	Bulk density	8gm/ml
5.	Spreadability	3 cm
6.	Colour	Brown
7.	Odour	Slight
8.	Taste	Sweet
9.	Angle of repose	Good

Table 3: Foaming character of formulation

Type	Percentage of solution	Volume of foam
Formulation	1%	0.924
	2%	1.125

Table 4: Bulk density of formulation

Type	Bulk density (gm/ml)
Untapped density	0.704
Tapped density	0.601

Table 5: Flow property of formulation

Type	Radius (cm)	Height (cm)	h/r	$\theta = \tan^{-1} h/r$
Formulation	4.1	5.0	0.82	39.35

Table 6: Zone of inhibition of Escherichia coli

Antibiotic	Zone of Inhibition	Result
Sample 1	1.5 mm	Sensitive
Sample 2	1.3 mm	Sensitive
Erythromycin	2.0 mm	Sensitive

undesirable side effects such furthermore, viridians group streptococci including *S. mitis*, *S. mutans*,



Figure 1: Anti-bacterial activity of E.coli

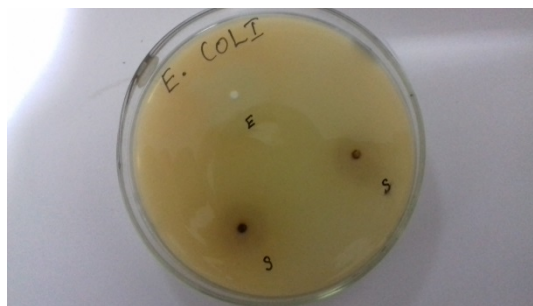


Figure 2: Anti-bacterial activity of streptococcus aureus

Table 7: Zone of inhibition of Streptococci aureus

Antibiotic	Zone of Inhibition	Result
Sample 1	1.0 mm	Sensitive
Sample 2	1.5 mm	Sensitive
Erythromycin	2.2 mm	Sensitive

C. albicans most representative human cariogenic bacteria are moderately resistant to antibiotics, therefore, search for the herbal dental care formulation could offer an effective alternative to antibiotic strategies for oral infection disease like dental caries (Figures 1 and 2) (Tables 6 and 7).

CONCLUSION

Natural plant products are an important source to control bacterial pathogens. Therefore, in the present study, a herbal tooth powder was developed and evaluated for antimicrobial activity which has shown excellent results. The ingredients are used in the present work, was screened and selected to possess anti-microbial effect and to maintain oral hygiene as it claimed by its results as effective tooth powder. 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. Oral hygiene can be maintained in a reliable, safe, and inexpensive way by using herbal tooth powder.

CONFLICT OF INTEREST

Authors declared no conflict of interest.

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