



# FORMULATION AND EVALUATION OF HERBAL TOOTH POWDER

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**Abstract:** This abstract presents the development and evaluation of herbal tooth powders with the aim of providing a natural alternative for oral care. With growing concerns about the potential risks associated with synthetic chemicals and additives commonly found in commercial toothpastes, the demand for herbal and natural oral care products is on the rise. A blend of carefully selected botanical substances with proven efficacy in improving oral health was used to create the Herbal Tooth Powder. These blends contained the antibacterial, anti-inflammatory, and refreshing properties of herbs. The powder formulation was created to ensure ease of use and efficient cleaning while improving general oral health. The evaluation of herbal tooth powder included various parameters including physical characteristics, microbial analysis and sensory evaluation. The physical properties of the powders was evaluated to meet the desired specifications. Microbial analysis was performed to verify the safety of the product and confirm the absence of harmful bacteria. Additionally, sensory evaluation was performed to assess factors such as taste, aroma and overall user experience.

**Keywords:** Natural, Oral care products, Botanical substances, Ease of use, Efficient cleaning.

## INTRODUCTION

Each person's health is a valued possession. The quality of life is significantly impacted by oral health, which is a crucial component of overall health. One of the fundamental components of dental health is a healthy dentition (Valkenburg et al, 2019). An essential oral hygiene practise, brushing your teeth prevents the buildup of oral biofilms that could otherwise result in tooth caries, gingivitis, and periodontal disease (Ledder et al, 2014). If the infection is not treated, it will spread and eventually result in tooth loss. Opportunistic bacteria, which are typically not harmful, make up the mouth's natural flora. This situation's imbalance leads to tooth decay and infection. Tooth decay is caused by the acid-producing bacteria *Streptococcus mutans*, which ferments carbohydrates (Shukla et al, 2019). Herbal remedies have a long history of use, are more patient-friendly, and are well accepted by the general population. Our only chance for sustainable supply of more affordable medications for the world's expanding population is that medical plants. Environmentally friendly methods are used for the production and processing of medicinal plants and herbal products. In developing nations like India with vast agro-climatic, cultural, and ethnic biodiversity, the availability of medicinal plants is not a problem (Prabha et al, 2014). There are claims that certain herbal components have amazing beneficial benefits on a range of dental issues, such as by creating a protective layer over teeth, supplying freshness, exerting an antibacterial impact, and reducing dental pain (Saloni et al, 2016). Herbalism is the practise of using plants and plant-based products for medical purposes. Any part of the plant can be used to make a herbal product, but the most common parts are the roots, leaves, flowers, and bark (Arshad et al, 2020). Even in the field of dentistry, interest in using products with a herbal base is growing. There are many herbs that have been shown to have an antiseptic effect. Numerous herbs are being used in India today to clean teeth. If herbs are proven to be helpful at reducing plaque, this will be crucial for maintaining dental health and for treating periodontal issues in a more cost-effective and secure manner (Kadam et al 2011). Abrasives like crushed bone, scrambled eggs, and oyster shells were once used to remove dirt from teeth in early attempts at dental cleaning. The first significant development was tooth powders, which contained ingredients like powdered charcoal. Bark powder and some flavour additives are applied to the teeth with a simple stick (Ganesan et al, 2008). There are often no chemicals, harmful substances, water, preservatives, etc. in tooth powder. It is simple to use, effectively cleans teeth, and promotes dental health (Devi et al 2019). Due to the unpleasant side effects of manmade treatments, researchers are attempting to focus more on herbal medications. Isolated plants and plants show effects that are Anti-inflammatory, anticancer, and immunological boosting properties (Ojha et al, 2018). Making tooth powders at home is easy and inexpensive. Different crude medications are added to herbal tooth powders to assist clean the mouth. The physiochemical characteristics of allopathic and herbal powders may depend on the micromeritics of the particles as all of these ingredients are made up of fine particles (Chidi et al, 2022). Due to greater public knowledge of the poisonous and harmful effects of chemicals, people are becoming more interested in using substances that are natural, and the creation of cosmetics is a result of the long-standing usage of herbal treatments. People used natural products in earlier days to maintain their oral hygiene and freshen their breath.

Dental health is a good indicator of overall wellness. In semi-urban and rural areas of India, toothpowder is the most often used method of oral hygiene due to budget considerations as well as the false belief that these locally produced herbal products may be good for dental and gingival health (Singh et al, 2016). In order to maintain good oral hygiene and avoid mouth infections, using herbal products is advised (Anitha et al, 2015). Toothpowder and toothpaste share the same ingredients, but toothpowders don't have any humectants, water, or binding agents. The formulation was assessed in accordance with Indian Herbal Pharmacopoeia standards and WHO recommendations (Devi et al, 2019). The main purpose of toothpowder is to clean the available surfaces. Finding an effective herbal dental care formulation could be a good alternative to using antibiotics to treat oral infection diseases like dental caries because the majority of representative human cariogenic bacteria are moderately resistant to antibiotics (Bharathi et al, 2020). The aim of the formulation and evaluation of herbal tooth powder is to provide a natural and effective alternative to conventional toothpaste, promoting oral health and hygiene while minimizing the use of synthetic ingredient.

## IDEAL PROPERTIES OF HERBAL TOOTH POWDER

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

## MATERIALS & METHODS

### COLLECTION OF HERBAL INGREDIENTS AND EXCIPIENT PROFILE

Herbal ingredients and excipient 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, Kadukkai and Karuvellampattai.

### SELECTION OF EXCIPIENT PROFILE

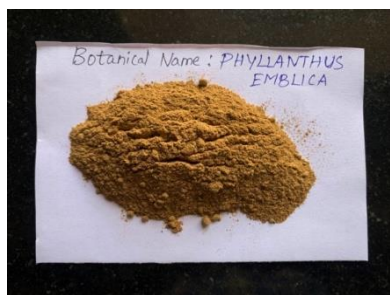
Select an appropriate base material that will provide a mild abrasive action for cleaning teeth without being too harsh on the enamel. These may include Menthol crystals, Himalayan rock salt and Bentonite clay.

### PREPARATION OF THE TOOTH POWDER

The herbal ingredients were dried under shade and powdered using mixer. The powdered herbs 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 ingredients is summarized in formulation of herbal tooth powder.

### FORMULATION OF HERBAL TOOTH POWDER

#### AMLA POWDER



**Common name:** Amla, Indian gooseberry

**Family:** Euphorbiacea

**Scientific name:** Phyllanthus emblica Linn

**Parts used:** Pericarp of dried matured fruits

**Role:** Antibacterial

**Treatment:** Periodontal diseases

**Fig 1:** Amla powder

## CINNAMON POWDER

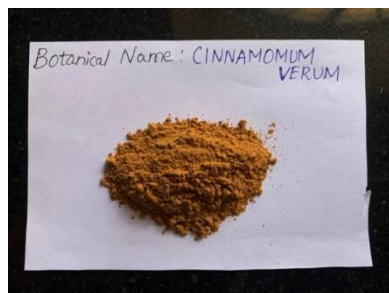


Fig 2: Cinnamon powder

**Common name:** Cinnamon  
**Family:** Lauraceae  
**Scientific name:** Cinnamon verum  
**Parts used:** Bark  
**Role:** Analgesic, Germicide, Antimicrobial  
**Treatment:** Toothache, Halitosis

## CLOVE POWDER

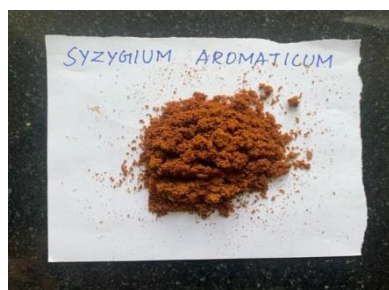


Fig 3: Clove powder

**Common name:** Clove, Lavang  
**Family:** Myrtaceae  
**Scientific name:** Eugenia caryophyllus  
**Parts used:** Dried flower buds  
**Role:** Analgesic, Antioxidant, Anti-inflammatory  
**Treatment:** Caries cavities, Dentrifice

## GUAVA LEAF POWDER

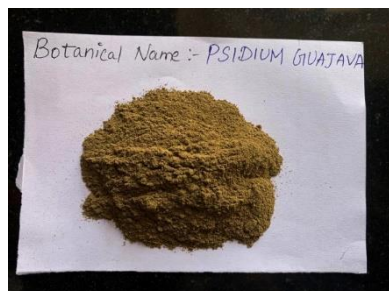


Fig 4: Guava leaf powder

**Common name:** Guava  
**Family:** Myrtaceae  
**Scientific name:** Psidium guajava  
**Parts used:** Leaf  
**Role:** Antibacterial  
**Treatment:** Toothache, Bleeding gums

## KADUKKAI POWDER



Fig 5: Kadukkai powder

**Common name:** Kadukkai, Harada  
**Family:** Combretaceae  
**Scientific name:** Terminalia chebula  
**Parts used:** Dried immature fruits  
**Role:** Anti-caries  
**Treatment:** Cavities, Tooth decay

## KARUVELLAMPATTAI POWDER



Fig 6: Karuvellampattai powder

**Common name:** Karuvellampattai, Babul

**Family:** Fabaceae

**Scientific name:** Acacia nilotica

**Parts used:** Bark

**Role:** Analgesic, Anti-inflammatory

**Treatment:** Plaque, Gingivities

## MENTHOL CRYSTAL



Fig 7: Menthol crystals

**Common name:** Mint crystal

**Family:** Lamiaceae

**Scientific name:** Mentha arvensis

**Extract:** Mint essential oil

**Role:** Antimicrobial

**Uses:** Refreshing, Cooling, Flavouring agents

## HIMALAYAN ROCK SALT



Fig 8: Himalayan rock salt

**Common name:** Pink salt, Halite, Sendha namak

**Treatment:** Prevent the buildup of plaque and tarter

**Uses:** Flavouring agents

## BENTONITE CLAY



Fig 9: Bentonite clay

**Common name:** Montmorillonite

**Uses:** Remove stains on teeth, Polish enamel, Whiten teeth

## PROPORTIONS AND MIXING

The required quantities of herbal ingredients and other excipient profile were weighed according to the table-1. Mix all the ingredients thoroughly to ensure uniform distribution throughout the tooth powder. Then tooth powder is packed in to the sterile air tight container in cool and dry place.

**Table 1:** Proportions of herbal tooth powder with quantities

Ingredients	Quantities (gm)
Amla powder	10
Cinnamon powder	6
Clove powder	6
Guava leaf powder	15
Kadukkai powder	10
Karuvellampattai powder	15
Menthol crystals	3
Himalayan pink salt	15
Bentonite clay	20

## EVALUATION OF HERBAL TOOTH POWDER

The prepared herbal tooth powder was evaluated for its various parameters such as organoleptic evaluation, patch test, physico-chemical evaluation and anti-microbial activity.

### ORGANOLEPTIC EVALUATION

Organoleptic properties for several sensory aspects, such as colour, aroma, and taste, were carefully noted down as illustrated. Separate analyses of the organoleptic and morphological qualities of the raw medications and powder, such as colour, aroma, texture, and appearance, were performed.

#### Colour

The prepared tooth powder was evaluated for its colour. The colour was checked visually by naked eye.

#### Odour

Odour was checked by smelling the product.

#### Taste

Taste was manually checked by tasting the product.

#### Texture

Texture was evaluated in relation to product quality.

#### Appearance

The appearance was visually evaluated.

## PATCH TEST

Doing a patch test before implementing it completely. Check for allergic responses by applying a tiny amount of tooth powder scrub to a small area. The patch test include Swelling, Redness and Irritation.

## PHYSICO-CHEMICAL EVALUATION

### Determination of pH

Using a digital pH meter, the pH of the prepared herbal tooth powder was determined. Add 5g of tooth powder in 50ml of beaker. To this freshly boiled and cooled distilled water was added. Stir vigorously and make a mixture and its pH was measured.

### Determination of Bulk density

It is the weight of a powder volume unit. Expressed in g/ml. In a dried graduated measuring cylinder (10ml), approximately 5g of sample was weighed. The volume occupied by the powder was given in the formula for calculating the bulk density..

$$D = M/V$$

D = Bulk density, M = Mass of particles, V = Total volume occupied

### Determination of Tapped density

The increase in bulk density that results from mechanically tapping a container containing a powder sample is known as tapped density. 5g weighed formulation was taken and slowly added to the graduated cylinder (10ml). After that initial volume was noted and the sample is then tapped until no further volume reduction occurred. The value obtained after tapping was noted. Continued tapping until no further change in volume was observed. Tapped density was calculated by given formula.

$$\text{Tapped density} = \text{Weight of powder (g)} / \text{Tapped density (ml)}$$

### Determination of Angle of repose [Flow property]

The funnel was taken and fixed with a burette stand. The graph paper was placed below the funnel and distance between lower tip of the funnel and sheet was adjusted to height of 2cm. Add 25 g of powder and poured into funnel and it started following down onto the graph paper. Sample was poured in funnel from top till a heap of powder formed and touched the lower tip of the funnel. Then the circle was drawn around the graph paper. The average diameter and radius of the circle followed by height was recorded and calculated by using given formula

$$\Theta = \tan^{-1} H/R$$

H=Height of the powder cone, R=Radius of the powder cone

### Determination of Foaming power

50 ml of water was added to 2 g of tooth powder that had been placed in a measuring cylinder. After noting the initial volume, shaking was done ten times. The final volume of foam was measured and calculated using the given formula.

$$\text{Foaming power} = V1-V2$$

V1 = Volume in ml of foam with water, V2 = Initial volume with water

### Determination of Spreadability

About 0.6 g of sample was weighed and placed at the center of the glass slide and another glass slide was placed over it carefully. To prevent sliding, a 1.13 kg weight was positioned in the middle of the plate above the glass slide. After 30 minutes, the sample diameter (in centimeter) was measured.

### Determination of Abrasiveness

The fineness of the powder was measured using the abrasiveness parameter. A fingertip was used to quantify, 1g of sample and rub it on a glass slide for 15 minutes. It was noted that the slide's surface had scratches. The findings were arbitrarily expressed as "positive" and "negative" indicators in order to show the scratches on the glass slide. More positive signs indicated abrasiveness that was greater.

### ANTIBACTERIAL ACTIVITY

The antibacterial activity of prepared herbal tooth powder was performed by agar well diffusion method against bacterial strains. The bacterial strains used in the study were *Staphylococcus sp.*, *Pseudomonas sp.*, *Streptococcus sp.*, *Escherichia sp.*, In the initial, Muller hinton agar poured on to the petri plates and allowed to solidify then wells were made on the agar plates using cork borer (0.6cm diameter) separately. The culture of each strain was swabbed uniformly onto the individual petri plates. The wells were filled with various concentrations (25µg, 50µg, 75µg, 100 µg) of sample. The antibiotics penicillin was used as standards. The agar plates were incubated at 37°C for 24hrs. After incubation, the diameter (in mm) of a clear zone of growth inhibition was recorded and measured with the help of radius scale.

## RESULTS & DISCUSSION

### PROPORTIONS AND MIXING

Mixing the all powdered ingredients of measured composition thoroughly is essential to achieve a homogeneous blend.



**Fig 10: Proportions**



**Fig 11: Mixing**

## EVALUATION OF HERBAL TOOTH POWDER

The prepared herbal tooth powder was subjected to under mentioned evaluation

### ORGANOLEPTIC EVALUATION

Distinct parameters were studied such as: Color, Odour, Taste, Texture and Appearance.

#### Color

The color of the formulated and evaluated herbal tooth powder is shown brown. The prepared herbal tooth powder's colour matches the findings of (Dakhurkar et al, 2019) quite well. Similar findings were found in a study by (Bharathi et al, 2020), which found that tooth powder formulations were brown in colour. The herbal dentifrice made from *achyranthes aspera* Linn (apamarga) leaves according to a study by (Asnotikar et al, 2022), has a greenish-brown colour. According to a study by (Mamatha et al, 2022), tooth powder's colour is greenish black because the herbal substances employed in this investigation were different. In order to increase the stability of the tooth powder, (Dudhe et al, 2020) incorporated chemical components, which resulted in yellowish green.

#### Odour

The formulated tooth powder is pleasant odour because in this study preferred using menthol crystals which act as flavouring and freshening agent. (Asnotikar et al, 2022) produced an aromatic scent as a result of using *Cinnamomum camphora* as a flavouring agent. An aromatic scent was produced in a study by (Mamatha et al, 2022) since the majority of the ingredients were aromatic flavours. A study by (Dudhe et al, 2020) demonstrates features of scent due to the incorporation of chemical components in the ingredients. According to a study (Bharathi et al, 2020), there was a little scent. The results of a study by (Dakhurkar et al, 2019) revealed certain characteristics of scent.

#### Taste

The prepared tooth powder is astringent taste. According to a study by (Bharathi et al, 2020), the application of the sweetening agent stevia leaf produced a sweet flavour. According to a study by (Asnotikar et al, 2022), sweet and spicy components were present. The use of saccharin sodium, a sweetening ingredient, in a study by (Dudhe et al, 2020), produced a sweet flavour. Sweet and bitter tastes were noted in a study by (Dakhurkar et al, 2019).

#### Texture

The texture of the product is fine. A study by (Asnotikar et al, 2022) produced a fine powder as a consequence. According to a study (Dudhe et al, 2020), fine texture was produced.

#### Appearance

Appearance of the product is powdered form. A study by (Dudhe et al, 2020) shows powdered appearance. A study by (Mamatha et al, 2022) the acceptable appearance was observed.

**Table 2:** Organoleptic Evaluation

Parameters	Result
Color	Brown
Odour	Pleasant
Taste	Astringent
Texture	Fine
Apperance	Powder

## PATCH TEST

### Swelling

Does not show any swelling effect for the formulated ingredients. A study by (Dudhe et al, 2020) the results were same, which has a negative effect on swelling.

### Redness

Redness was not found for prepared herbal tooth powder. The results of the study by (Dudhe et al, 2020) were same, and thus led to the conclusion that redness is negative.

### Irritation

Irritation causing ingredients was not formulated. So, the product is free from irritation. A study by (Dudhe et al, 2020) the results were the same, which has negative irritation on teeth powder formulations.

**Table 3:** Patch Test

Parameters	Result
Swelling	Negative
Redness	Negative
Irritation	Negative

## PHYSICO-CHEMICAL EVALUATION

### Determination of pH

The pH of the formulation was found to be 5.19. Similar findings to those of pH 5 were seen in a study by (Dudhe et al, 2020). The pH value is 6 according to a study by (Bharathi et al, 2020). The pH level of tooth powder was 4.75, according to a study by (Asnotikar et al, 2020). The pH value was 7 according to a study by (Mamatha et al, 2020).

**Fig 12:** pH



### Determination of Bulk Density

Mass of the particles is 5g and total volume occupied is 10ml. The powder has 0.5g/ml of bulk density. According to a study by (Asnotikar et al, 2020), bulk density was determined to be 3.70, and the study's entire volume was 100ml. A study by (Dudhe et al, 2020) resulted the powder has 4gm/ml of bulk density.



**Fig 13:** Bulk density

### Determination of Tapped Density

Weight of the powder is 5g and tapped density is 6.9. The powder has 0.724g/ml of tapped density. The results were found to be similar by the study of (Bharathi et al, 2020), which found that tooth powder formulations have a tapped density of 0.601. According to a study by (Asnotikar et al, 2020), tapping density is 0.39g/ml.



**Fig 14:** Tapped density

### Determination of Angle of repose [Flow property]

Angle of repose determined to find out the flow property of herbal tooth powder and its value is 27.83 which shows excellent flow property. The results were similar with the results of (Mamatha et al, 2022), with a 30.62 observed value which shows the excellent flow property of herbal tooth powder. According to a study by (Asnotikar et al, 2020), produced herbal dentifrice has a 43.8 degree angle of repose. A study by (Bharathi et al, 2020) reported good flow property.



**a)** Sample poured in funnel



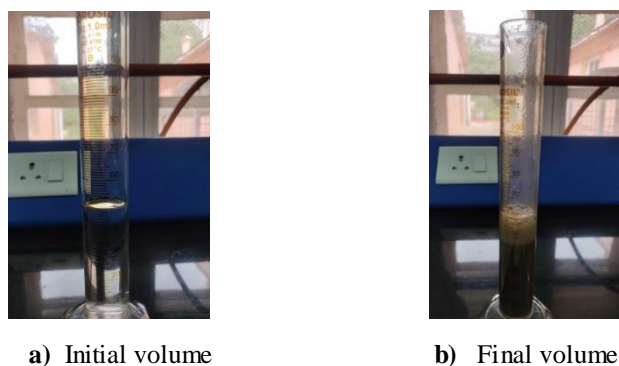
**b)** Cone shape pile

**Fig 15:** Angle of Repose

### Determination of Foaming power

Foaming power of the herbal tooth powder is 10ml which shows good foamability. Similar outcomes of the foaming power are shown in a study by (Asnotikar et al, 2022), where the value is 4ml. Foaming power is 0.9 ml, according to a study by (Bharathi et al.,

2020). Foaming power was determined to be 0.7 ml in a study by (Mamatha et al, 2022). Good foamability was reported in a study by (Dakhurkar et al, 2019). (Dudhe et al, 2020) demonstrated the presence of foam.



**Fig 16:** Foaming power

### Determination of Spreadability

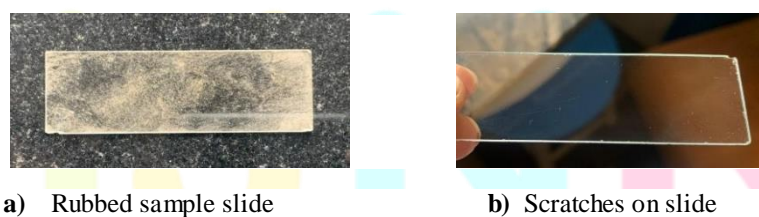
Spreadability of the tooth powder was found to be 3.5cm. Developed formulation was easily spreadable and which help to clean the teeth. The results were 3 cm, which was identical to the findings of (Bharathi et al, 2020). The spreadability of teeth powder was shown to be 4.7 cm in a study by (Asonotikar et al, 2020). Easily spreadable according to a study by (Dakhurkar et al, 2019).



**Fig 17:** Spreadability

### Determination of Abrasiveness

Scratches is present on the glass slide which shows positive indications of tooth powder has good abrasiveness. A study shows similar results with (Asnotikar et al, 2020) the formulated tooth powder has indicates positive sign. Good abrasive according to a study by (Dakhurkar et al, 2019).



**Fig 18:** Abrasiveness

**Table 4:** Physico-chemical Evaluation

Parameters	Result
pH	5.19
Bulk density	0.5g/ml
Tapped density	0.724g/ml
Angle of repose	27.83 (Excellent)
Foaming power	10ml (Good)
Spreadability	3.5cm (Easily spreadable)
Abrasiveness	++ (Good abrasive)

**ANTIBACTERIAL ACTIVITY**

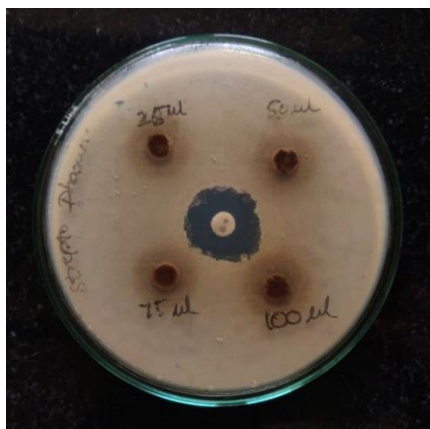
Agar well diffusion method was used to determine the antimicrobial activity which was recorded by measuring the zone of inhibition using the radius scale appeared after the incubation period of the organisms. In this study the antibacterial activity of formulated herbal tooth powder were investigated against Gram positive bacteria (*Staphylococcus sp.*, *Streptococcus sp.*) and Gram negative bacteria (*Escherichia sp.*, *Pseudomonas sp.*). The zone of inhibition against selected bacterial pathogens against formulated tooth powder was compared with the standard antibiotic penicillin and the results were presented in (Table-5, 6 and 7), Fig-19, 20, 21 and 22) shows the zone of inhibition of selected bacterial pathogens against formulated tooth powder.



**Fig 19:** *Staphylococcus sp.*,



**Fig 20:** *Pseudomonas sp.*,



**Fig 21:** *Streptococcus sp.*,



**Fig 22:** *Escherichia sp.*,

**Zone of Inhibition of *Staphylococcus sp.*,**

**Table 6:** Zone of Inhibition of *Pseudomonas sp.*,

Concentration of sample (µg/ml) & Antibiotic	Zone of Inhibition (mm)	Result
25	11	Resistant
50	12	Sensitive
75	13	Sensitive
100	14	Sensitive
Penicillin	15	Sensitive

**Zone of Inhibition of *Pseudomonas sp.*,**

**Table 6:** Zone of Inhibition of *Pseudomonas sp.*,

Concentration of sample (µg/ml) & Antibiotic	Zone of Inhibition (mm)	Result
100	15	Sensitive
Penicillin	17	Sensitive

**Zone of Inhibition of *Streptococcus sp.*, and *Escherichia sp.*,****Table 7:** Zone of Inhibition of *Streptococcus sp.*, and *Escherichia sp.*,

Test organisms	Zone of Inhibition	Result
<i>Streptococcus sp.</i> ,	No	Resistant
<i>Escherichia sp.</i> ,	No	Resistant

In the present study, antibacterial activity of formulated herbal tooth powder exhibited the significant inhibition against the tested pathogens and observed higher activity against *Staphylococcus sp.*, and *Pseudomonas sp.*, compared with all other bacteria. Hence, it was confirmed that the prepared tooth powder possess the great antibacterial potential and it could be applicable for the bacteria causing oral infection. The study by (Bharathi et al, 2020), which discovered that the antibacterial activity of *Escherichia sp.*, and *Staphylococcus sp.*, resulted in sensitive to the oral infection, found that the results were similar. According to a study by (Dudhe et al, 2020), *Escherichia sp.*, was found to be sensitive to anti-microbial activity. The prepared product is efficient against the *Streptococcus sp.*, according to a study by (Mamatha et al, 2022).

**SUMMARY AND CONCLUSION**

The formulation and evaluation of the herbal tooth powder yielded promising results, suggesting its potential as a natural and effective dental care product. The use of carefully selected herbal ingredients provided antimicrobial properties, helping to maintain oral hygiene and prevent common oral health issues. The fine texture and pleasant aroma of the tooth powder enhance its user-friendliness and consumer appeal. Overall, herbal tooth powders offer a natural and chemical-free alternative for maintaining oral hygiene. They can be an excellent option for individuals who prefer natural products and are looking to incorporate herbal remedies into their oral care routine. Further research and testing can be conducted to optimize the formulation and assess long-term effects.

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