



FORMULATION AND EVALUATION OF ANTIBACTERIAL TOOTH POWDER

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ARTICLE INFO

Key words:

Camphor, Bentonite, Calcium carbonate, SLS, Sodium Saccharin, Antibacterial,

Access this article online
<https://www.jgtps.com/>
Quick Response Code:



ABSTRACT

The Present study involves formulation and evaluation of Antibacterial tooth powder. The research work constitutes its focus on formulating a new antibacterial tooth powder with the ingredients Bentonite and camphor. Various Combinations were made by using these two active ingredients/ antibacterial agents along with calcium carbonate as abrasive agent, Sodium Lauryl Sulfate as foam producing agent, Sodium Saccharin as sweetening agent & Peppermint oil as flavouring agent. 8 formulations were made by using the above ingredients & were evaluated for Physical appearance, PH, Bulk density, Tapped density, carr's index, Angle of repose, moisture, Foaming powder and Invitro anti bacterial activity. Zone of inhibition for F3 obtained was best compared to other formulations against streptococcus sobrinus after incubating for 24 hours.

INTRODUCTION

One of the oldest human inventions include oral cleansing products. Dental tooth powder was developed around 3000-5000 B.C by ancient Egyptians. Variety of products like egg shells, oxen bones are powdered to ashes and been used as tooth powder.¹ The tooth decay which occurs due to oral infections highly affects the adults and aged people and is sometimes responsible for early death. These diseases are mainly caused by plaque forming bacteria and yeast that reside in the oral cavity.² Tooth powders are the simplest, cheapest and the oldest preparations. Oral hygiene is an important key to maintain good appearance, impression of individual and gives confidence. Tooth powders are based on its abrasive property, the powder applied on tooth rub against the tooth which helps to remove the deposited food junk and minerals from tooth.³ Although mechanical plaque control methods have the potential to maintain adequate level of oral hygiene,

Clinical experience and population based studies have shown that such a methods are not being employed accurately by a large number of people. Therefore many chemo prophylactic agents such as oils, powders have been developed to control bacterial plaque.⁴ Tooth powder is a dentifrice preparation used for cleaning and polishing teeth that has been used for centuries, some of the earliest tooth powder were remains their tooth powder consists of finely grind or powdered, sometime burnt substance such as pumice, horns, bones, hooves, eggshells, and the shells from mollusks such as the oyster and murex.⁵

Ideal properties: ⁶

- Good abrasive effect.
- Nonirritant and nontoxic.
- Prolonged effect.
- Keep the mouth fresh and clean.
- Impart no stain in tooth.
- Cheap and easily available.

Types of Tooth powder:

Tooth powder are classified into two types.

1. Foaming,
2. Non-foaming.

The tooth powder shall be smooth, uniform, free following fine powder and free from foreign matter. It shall be fine from abrasive materials. Tooth powder in granular or coarse powder foam is also marketed like Gopal tooth powder. The particle size depends on the costumer's choice, since psychologically a coarse powder is preferred to have abrasive action.

Requirements of Tooth powder

The basic requirement of tooth powder are as follows.

It shall clean the teeth adequately i.e., remove food debris, plaque and foreign matter from teeth.

The mouth and teeth shall be left with fresh and clean feeling.

The cost must be such that regular and frequently use is not de barred by price consideration.

It must be capable of being packed economically and be stable in storage for the commercial shelf life.

Main requirement of costumer is to protect against decay of teeth and gum troubles.

Ingredients:⁷

Commercially used ingredients in tooth powder

- Preservative
- Flavoring agent
- Sweetening agent,
- Surface active agent
- Coloring agent,
- Abrasive agent.

Abrasive agent:

Also called as cleaning agent or polishing agent. These remove stain on the teeth and usually contribute about half of the total weight of powder.

E.g.:

- Precipitated calcium carbonate,
- Insoluble sodium meta phosphate,
- Hydrated alumina,
- Aluminum hydroxide(Microcrystalline),
- Calcium phosphate di hydrate,
- Alumina tri hydrate,

- Light magnesium carbonate,
- Magnesium silicate,
- Colloidal kaolin,
- Silica aerogel.

Surface active agents:

These are also called detergents or foaming material. They clean the teeth by lowering of surface tension which promote penetration of tooth powder. There by assisting removal of debris. They also cause emulsification and subsequent removal of mucus.

E.g.

- Tallow soap in pure form
- Sodium lauryl sulfate,
- Sodium coconut mono glyceride sulfate,
- Sodium lauryl sulfonate,
- Sodium sulphosuccinate,.

Flavoring and sweetening agent:⁸

It is used for importing suitable flavor and taste to the final product.

Eg ;

- Peppermint oil,
- Saccharine,
- Saccharine sodium,
- Spearmint and Aspartame.

Coloring agent:

E.g.: chlorophyll,

TiO₂ and colors approved under the relevant schedule of drugs and cosmetic rules.

Preservatives:

Such as sodium benzoate, mixture of methyl and propyl parabens are used by some manufacturers.

PREPARATION OF TOOTH POWDER:⁸

All the powder ingredients are size reduced to fine powder by using mortar and pestle and pass through 85 mesh (sieve). Now weigh all the required quantity of ingredients separately by using weighing balance. Transfer all the weighed ingredients in a mortar and pestle according to their weights in ascending order and triturate with the help of pestle, until all ingredients are homogenously mixed and finally add fragrance for good flavor.

EVALUATION OF TOOTH POWDER:^{10,11}

Physical appearance / Visual inspection:

The formulation was prepared and observed for color, odour⁹ and appearance and its stability.¹⁰

2. Determination of PH:

10g of tooth powder is taken in a 150 ml beaker. Add 10ml of freshly boiled and cooled water at 27°C. Stir well to make a thorough suspension. Determine the PH meter.

3. Determination of bulk density:

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

Bulk density = untapped density- tapped density

4. Determination of tapped density:

Take 50gm of powder, pass through sieve No: 20, weigh 20gm of sieve powder. Transfer this powder into 50ml granulated cylinder, tapped volume determined by tapping on wooden surface 50 times. Tapped density can be calculated by using the Formula:

$$\text{Tapped density} = \frac{\text{Tapped mass of powder}}{\text{Volume occupied after tapping}}$$

5. Determination of Carr's index:

In order to determine Carr's index, first we have to calculate bulk density and tapped density of sample.

Carr's Index can be calculated by using formula,

$$\text{Carr's index} = \frac{100 \times (V_o - V_f)}{V_o}$$

Where 'V_o' is the initial volume of powder and 'V_f' is final volume of tapped powder

6. Determination of angle of repose:

To perform angle of repose, we require sample, burette stand, funnel and butter paper. Take a clean and dry funnel, attached to burette stand. Now pass the powder from the height of 2cm allow it to create a pile, using a pencil draw a circle around it and calculate radius. Angle of repose can be determined by using Formula,

$$\text{Angle of repose } (\theta) = \tan^{-1} \left(\frac{h}{r} \right)$$

Where, 'h' is the height of heap and 'r' is the radius of heap made by powder.

7. Determination of moisture content:

10 gm of tooth powder is weighed and dried it in hot air oven at 105 c then it was cooled. The loss of weight is recorded as percentage moisture content, and calculate by using formula

$$\% \text{ moisture content} = \frac{\text{Original sample weight} - \text{dry sample Weight}}{\text{Original sample weight}}$$

8. Determination of foaming power:

The product was evaluated for foam ability by taking small amount of preparation which 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 can be calculated by using formula : Foaming power = V₁ - V₂

9. Invitro anti-bacterial activity:¹¹

The prepared tooth powder for F3 was subjected to antibacterial activity by cup plate method using Agar medium.100mg/ml was used to study this antibacterial activity. The petri plates were then sealed using parafilm and incubated at 37° for 24 hrs. The zone of inhibition for formulation F3 was found to be 0.7mm.

Table 1: Compositions of tooth powder.

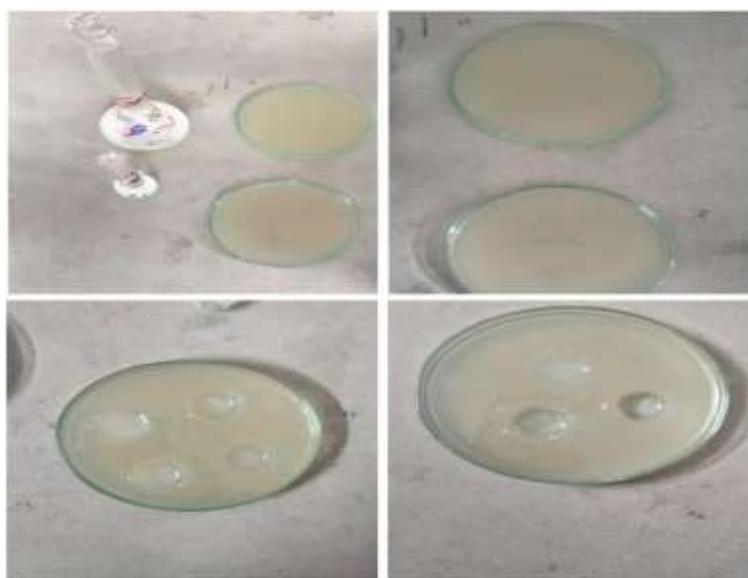
S.no	Ingredients in tooth powder	F1	F2	F3	F4	F5	F6	F7	F8
1.	Bentonite	0.25	0.50	0.75	1	1.25	1.50	1.75	2
2.	Camphor	2	1.75	1.50	1.25	1	0.75	0.50	0.25
3.	Calcium Carbonate	90	90	90	90	90	90	90	90
4.	Sodium lauryl sulfate	2	2	2	2	2	2	2	2
5.	Saccharin Sodium	1	1	1	1	1	1	1	1
6.	Peppermint oil	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table 2: Evaluation of formulation for physical appearance, Tapped density , P^H, Bulk density

S.No	Formulation	Physical appearance	Tapped density	P ^H	Bulk density
1.	F1	White	1.17	7.93	0.76
2.	F2	White	1.26	7.58	0.82
3.	F3	White	1.48	7.94	0.98
4.	F4	White	1.33	7.89	0.79
5.	F5	White	1.16	7.87	0.74
6.	F6	White	1.08	7.95	0.70
7.	F7	White	1.24	7.97	0.81
8.	F8	White	1.15	7.92	0.71

Table 3: Evaluation for foaming powder, moisture

S. No	Formulation	Foaming powder	Moisture content	Angle of repose	Car's index
1.	F1	0.45	0.45	34.6	35.04
2.	F2	0.50	0.51	33.4	34.92
3.	F3	0.55	0.58	32.4	33.78
4.	F4	0.60	0.64	36.1	35.77
5.	F5	0.70	0.69	37.2	36.20
6.	F6	0.80	0.71	34.9	35.18
7.	F7	0.90	0.76	32.6	34.67
8.	F8	0.95	0.79	39.4	38.26



RESULTS AND DISCUSSION

The aim of the present work is to prepare antibacterial activity tooth powder by using bentonite and camphor. The prepared antibacterial tooth powder was evaluated for physical appearance, P^H, bulk density, tapped density, carr's index, angle of repose, moisture content, foaming power and *invitro* antibacterial studies. Physical appearance /Visual inspection: The formulations prepared were appeared in white color (Table 2).

Determination of PH: The PH of the formulated tooth powder was determine at room temperature 25°C and PH range was found to be 7.58-7.97 (Table 2).

Determination of bulk density: The bulk density was determined by using formula and it was found to be 0.70-0.98g/ml (Table 2).

Determination of tapped density: The taped density was determined by using formula and it was found to be 1.08-1.48g/ml (Table 2).

Determination of carr's index: The carr's index was determined by using formula and it was found to be 33.78-38.26 (Table 3)

Determination of angle of repose: The angle of repose for the formulation was determined and it was found to be 32.4°-39.4° (Table 3).

Determination of moisture content: The moisture content was determined by using formula and it was found to be 0.45% - 0.79 % (Table 3).

Determination of foaming power: The foaming power was determined by using formula and it was found to be 0.45-0.95 (Table 3).

Antibacterial activity against streptococcus sobrinus: The prepared tooth powder formulation F3 was subjected to antibacterial activity by cup plate method using the agar medium. 100mg/ml was used to study this antibacterial activity. The zone of inhibition was observed successfully for formulation F3 was found to be 0.7mm than other formulations.

CONCLUSION

In the present work efforts has been made to prepare and evaluate the Antibacterial tooth powder by using two antibacterial agents such as Camphor, Bentonite, by various combinations. Zone of inhibition for F3 obtained was best compared to other formulations against streptococcus sobrinus after incubating for 24hours. It may have fair antibacterial activity efficiency. Hence the formulation F3 has met the objectives of the present study which may hold promise for further studies.

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