FORMULATION AND EVALUATION OF EFFERVESCENT TOOTHPASTE TABLETS

Kushare Aditi[1], Londhe Shweta[1], Magar Sakshi[2], Lonkar Gauri[3]

Assistant Professor[1], UG Student[1], UG Student[2], UG Student[3], UG Student[4]

DEPARTMENT OF PHARMCEUTICAL QUALITY ASSUARANCE.[1]

MAHATMA GANDHI VIDYAMANDHIR'S PHARMACY COLLEGE,

PANCHAVATI, NASHIK.[1,2,3,4]

ABSTRACT:

The creation and assessment of effervescent teeth foaming pills as a novel, environmentally responsible substitute for traditional toothpaste is the main objective of this study. Toothpaste tablets provide a sustainable, zero-waste alternative to traditional toothpaste packaging, which greatly increases plastic waste. Using ingredients including calcium carbonate, sodium bicarbonate, citric acid, and tartaric acid, the tablets, formulation combines whitening, foaming, and cleaning capabilities. These chewable pills are perfect for everyday usage and travel since they foam when chewed, removing the need for water or a toothbrush. To create tablets with uniform physicochemical properties, direct compression was used. Good flow qualities were validated by pre-compression parameters such Carr's index, bulk density, tap density, and angle of repose. Weight variation, hardness, friability, effervescence duration, foamability, and pH were all assessed after compression. The standard batch 3 formulation was found to be the best, exhibiting the shortest effervescence time, good foaming ability, and satisfactory mechanical strength. According to the study's findings, effervescent teeth foaming pills offer a useful, sustainable, and efficient alternative for oral hygiene, with encouraging prospects for market growth and personalization.

KEYWORDS:

Effervescent tablet ,toot foaming, toothpast tablet, sustainable oral care, foamability, effervescence time, oral hygiene, eco-friendly.

INTRODUCTION:

A tooth-cleaning tablet that both foams and cleans itself while being chewed, featuring a self-foaming effervescent couple composition that makes it easy for the tablet to create a foam while being chewed without the need to agitate it with a toothbrush or draw air into the mouth.[1] Since ancient times, toothbrushes have been a vital and indispensable part of dental health care.[2] Between 300 and 500 BC, toothpaste compositions were first created in China and India. Egg and clam shells, as well as crushed bone, were used as abrasives to clean teeth during that time. The 19th century saw the development of contemporary toothpaste formulas. Eventually, soap and chalk were added to those mixtures. Sodium lauryl sulfate was employed as an emulsifying ingredient in a number of detergent formulation developments that started after 1945. The release of active substances during formulation development to prevent and/or treat oral sickness has become the main emphasis in recent years.[3] A dentifrice called toothpaste is used to clean, preserve, and enhance the condition of teeth. Toothpaste aids in the removal and/or veiling of halitosis, releases active ingredients like fluoride to help prevent tooth and gum disease (e.g., gingivitis), and serves as an abrasive to help prevent dental plaque and food particles from the teeth.[4] Its primary purpose is to promote oral cleanliness Toothpastes consist of complicated mixes of abrasives, surfactants, binders, and antidrying ingredients including humectants, which create a pleasant mouthfeel and prevent dryness. In order to prevent the liquid phase from separating from the toothpaste, binder keeps the solid phase appropriately suspended in the liquid phase. Additionally, they provide the dentifrice substance, particularly after it is extruded from the tube onto the toothbrush. Understanding toothpaste ingredients and recommending various products to patients depending on their specific needs are the duties of the oral health expert.[5]

•What is a Tooth foaming tablet?

A toothpaste is defined as a semi-solid material for removing naturally occurring deposits from teeth and is supposed to be used simultaneously with a toothbrush.

Ideal properties of toothpaste:

- Good abrasive effect
- Non-toxic and non-irritant
- Don't leave any stains on the teeth.

- Keep the mouth clean and fresh
- Prolonged effect
- Budget friendly and easily available

Oral cavity:

The first area of the digestive system to be reached is the oral cavity, also referred to as the mouth or buccal cavity. It is composed of a number of physically separate components that cooperate to successfully and efficiently carry out a variety of tasks. These include the palate, lips, tongue, and teeth. Despite its small size, the mouth cavity is a unique and complex structure that contains numerous nerves and blood vessels. Due of its distinct and varied importance in human existence, this intricate network is necessary. [6]

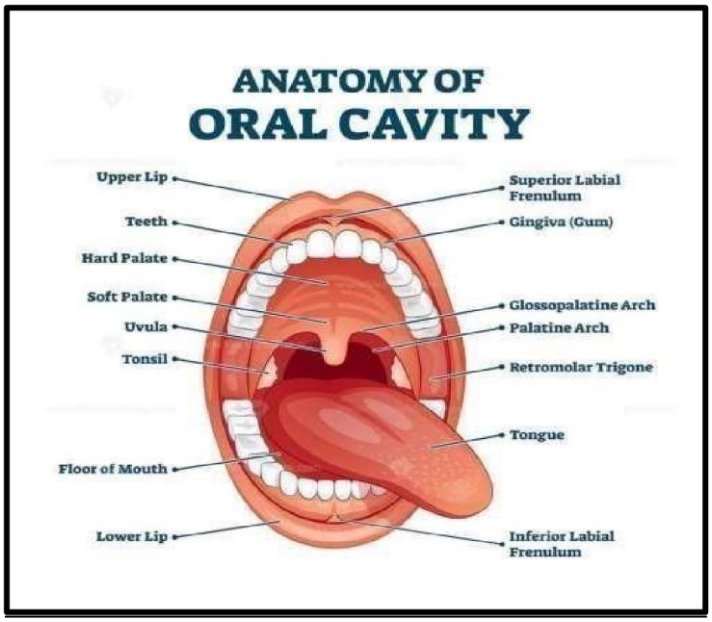

Fig. 1: Structure of oral cavity [7]

Tooth:

The teeth are hard, white structures found in the mouth. Different vertebrate species occasionally have specialized teeth that are used for mastication. Each tooth is composed of a crown and one or more roots. The portion of the tooth above the gum line that is visible and functional is called the crown. The tooth's invisible root is what holds it up and secures it to the mandible. In various parts of the mouth, the crowns and roots of various animals have unique shapes. On one side of the jaw, the teeth are

almost the same as on the other. The upper teeth cooperate with the lower teeth and are separate from them.[8]

Structure of the teeth:

Four dental tissues make up your teeth. Enamel, dentin, and cementum are the three hard tissues. Pulp, or the soft, non-calcified tissue in the center of the tooth that contains nerves, blood vessels, and connective tissue, is the fourth tissue. (Figure 1)

Enamel: In the crown of the tooth, calcified tissue covers the dentin. Tooth enamel is unable to repair damage caused by decay or wear because it lacks active cells. These problems can only be fixed by a dentist.

Gums: are a type of gum that is used to (also called gingiva.) Soft tissues that cover and protect your teeth's roots, as well as teeth that haven't yet erupted.

Pulp: Chamber is an acronym for “pulp chamber”. The pulp—the soft tissue at the middle of your teeth that contains nerves, blood arteries, and connective tissue takes up this space.

Neck: The point at which the crown meets the root.

Dentin: Underneath the enamel and cementum is the pulp of the tooth. It has minute tubules in it (small hollow tubes or canals). When the protective layer (enamel) on the dentin wears away, the tubules allow heat and cold, acidic, or sticky foods to activate the nerves and cells inside the tooth, resulting in insensitivity,

Bone: In the jaw (Alveolar Bone.) The portion of the jaw that protects the tooth roots.

Cement: The cementum, the periodontal ligament is attached to the hard connective tissue that covers the tooth root.[9]

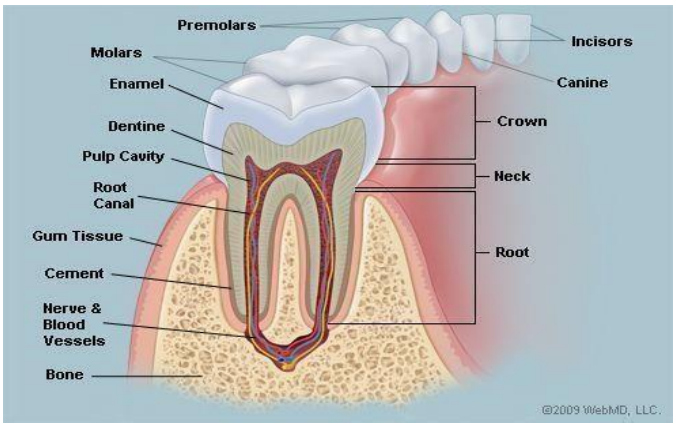

Fig 2. Structure of teeth[10]

Toothpaste tablets:

Toothpaste tablets are chewable versions of the paste we've all used since we were children. That's not entirely true. Simply place one in your mouth, chew it to break it up, then brush as usual. There are all-natural and vegan-friendly alternatives available, and the tablets crumble and foam as you brush (no water required)[11] For personal care items in their purchases, consumers place a high value on sustainability and clean label attributes. Retailers' shelves are stocked with reusable and environmentally friendly products. Traditional toothpaste tubes, on the other hand, are harmful to the environment, owing to the packaging materials used. Tablets of toothpaste are therefore becoming a viable remedy. Toothpaste tablets are tiny, bite-sized chewables that work similarly to regular toothpaste when chewed into a paste before brushing. Toothpaste tablets use toothpaste compositions without water, such as calcium carbonate, sodium bicarbonate, and derivatives of tartaric acid.[12] Tablet toothpaste is a more environmentally friendly option than toothpaste. The portability and temperature resistance of these goods are advantageous. As a result, consumers no longer need to carry around heavy toothpaste tubes or be concerned about the paste drying up because they forgot to close the cap. When traveling, chewable toothpaste tablets are a good way to keep your teeth clean. Users can use the containers for quick cleaning even without a toothbrush, and they are conveniently transportable in tiny bags. Toothpaste pills are still not well known by consumers, and big-box stores do not carry them. Additionally, because there is insufficient clinical trial evidence, toothpaste tablets have not yet received approval from groups like the American Dental Association. In the dental care industry, fluoride-free solutions are not well-regarded since they may raise the risk of cavities and because switching from toothpaste to tablets may make consumers uncomfortable.[11,12]

Fig 3: Toothpaste Tablet chewing

Effervescent tablets:

Effervescent tablets are uncoated tablets that release carbon dioxide upon contact with water, facilitating their breakdown. In a matter of minutes, the tablets completely dissolve, and the medication is accessible in solution form. When a weak organic acid, such as citric or tartaric acid, reacts chemically with a carbonate or bicarbonate salt, such as sodium bicarbonate, in the presence of water, carbon dioxide is produced. Because of the high concentration of carbonate salt, the pH of the stomach is temporarily elevated after ingeating the pharmaceutical solution, which causes the stomach to empty quickly.[13]A CO2 inducer (adipic acid, malic acid, tartaric acid, ascorbic acid, fumaric acid, maleic acid, succinic acid, or citric acid) and a CO2 releaser (sodium carbonate or sodium bicarbonate) are commonly included in effervescent tablet formulations. If API has a low solubility, it either dissolves into the salt form during the dissolving process or is present in the effervescent granule combination. Effervescent tablets are created by combining these substances with binders, diluents, and lubricants. The tablets are then crushed. Water-soluble lubricants include adipic acid, polyethylene glycol, and sodium benzoate. Magnesium stearate, the most widely used lubricant, disrupts the effervescence process since it is insoluble in water. Effervescent tablet formulation does not require disintegrants since in situ CO2 facilitates the disintegration process.[14] To alter the rate of

effervescence, employ a plasticizer. The rate of effervescence decreases as the amount of plasticizers increases. By changing the hydrophobicity and hydrophilicity of the binders used in the hot-melt extrusion process, effervescence can also be altered. As more hydrophobic binder is added, the rate of effervescence decreases. Additionally, the effervescence rate will be higher when a small excess of either acidic or alkaline agents is utilized than when both agents are used in the same quantity. Additionally, medications can be delivered to the desired region in the gastrointestinal tract by coating these effervescent tablets.[15]

Mode of Action:

The aetiology of dentine hypersensitivity (DH), a frequent and painful tooth ailment, is multifactorial. DH also seems to be compatible with the hydrodynamic mechanism explanation of dentine sensitivity, which describes lesions that have a lot of open dentinal tubules at the pulp's surface. DH is only possible by definition when dentine is exposed (lesion localisation) and tubules are opened (lesion initiation), allowing for greater fluid flow in the tubules upon stimulation. In both processes, erosion seems to be a major factor, especially from dietary acids. The majority of toothpaste formulations are additive, even synergistic, to erosive enamel loss, although they also induce clinically negligible enamel wear when used alone. Additionally, "healthy" gingival recession is linked to toothpaste use.[16]

NEED:

- Effervescent Tooth Foaming Tablet for teeth whitening and polishing.
- Sodium bicarbonate, which pierces the coating of plaque
- The purpose of effervescent tablets is to create a solution that simultaneously releases CO2.
- Toothpaste tablets are environmentally friendly, zero-waste, and plastic-free.
- The sustainable oral care option is toothpaste pills.

MATERIAL AND METHOD:

CHEMICAL REAGENTS:

SR. No	MATERIALS	USE
1)	Calcium carbonate	Abrasive
2)	Sodium bicarbonate	Penetrates the plaque layer
3)	Citric acid	Effervescent agent

4)	Tartaric acid	Effervescent agent
5)	Glycerol	Humectant
6)	Saccharine	Sweetening agent
7)	Sodium Lauryl Sulfate	Surfactant
8)	Starch	Disintegrant
9)	Sodium benzoate	Lubricant, preservative
10	Menthol	Cooling agent
11)	Eucalyptus oil	fragrance

Table 1: Material and uses

Role of sodium Bicarbonate:

In effervescent systems, sodium bicarbonate is the primary source of carbon dioxide. It's cheap, non- hygroscopic, and totally soluble in water. Both by itself and in combination with other antacids, it is commonly used as an antacid. It is widely used as baking soda in food goods and as a component of fire extinguishers that contain soda and acid and dry chemicals. Of the sodium alkalies, it is the least harsh.[17]

Role of Menthol:

Menthol mouthwash significantly lowers bleeding, gingival, and plaque indices. Menthol mouthwash is an anti-gingivitis and anti-plaque agent.[18]

Role of glycerol:

Glycerol finds extensive application in the food industry as a sweetener and in pharmaceutical formulations as a humectant. Tooth decay and cavities are caused by bacteria that develop plaques and are not fed or nourished by glycerol. Additionally, because glycerol warms and heats the mouth, it is advised as an additive when using artificial sweeteners like xylitol that have a cooling impact.[19]

Role of eucalyptus oil:

Eucalyptus oil is regarded as an adjuvant treatment for endodontic infections and dental cavities by inhibiting the proliferation of oral microorganisms.[20]

INSTRUMENTS AND APPARATUS:

SR.NO	INSTRUMENTS
1	Electronic balance
2	pH meter
3	Hot air oven
4	Tablet punching machine
5	Monsanto hardness tester
6	Roche friabilator

Table 2: Instruments and apparatus

FORMULATION OF EFFERVESCENT TOOTHPASTE TABLET:

Ingredients	B1	B2	B3
Calcium carbonate	105mg	105mg	105mg
Sodium bicarbonate	50mg	25mg	37.5mg
Citric acid	25mg	25mg	25mg
Tartaric acid	25mg	25mg	25mg
Saccharine	10mg	10mg	10mg

Glycerol	200mg	225mg	212.5mg
Sodium Lauryl Sulfate	50mg	50mg	50mg
Starch	30mg	30mg	30mg
Sodium benzoate	5mg	5mg	5mg
Menthol	Q.S.	Q.S.	Q.S.
Eucalyptus oil	Q.S.	Q.S.	Q S.

Table 3: Formulation of Effervescent Toothpaste Tablet

DIRECT COMPRESSION:

The easiest and most cost-effective way to make tablets is by direct compression, which has altered the tablet production process and created opportunities for direct compression by requiring fewer spray-drying processing steps. Tableting compression is the process of compressing tablets straight from active ingredient powder mixes so they flow evenly through dies and create a compact film.[21,22]

PROCEDURE:

(1) Accurately weighed the required quantity of all the ingredients

(2) The above-weighed ingredients were blended using the mortar and pestle to form a homogeneous powder

(3) Then sufficient quantity of Eucalyptus oil (1 drop) is added into the homogeneous powder and again blended to form granules

(4) The granules were dried at 50° C for 15 - 20 minutes using a hot air oven

(5) Accurately weighed lubricant (Sodium benzoate) was added into the dried granules and mixed

(6) By direct compression method; the above-dried granules were punched using punch size numbers and shallow convex-shaped effervescent toothpaste tablets were formed.[23]

Fig :4 Ingredients mixed

Fig :5 Dried Granules of powder

EVALUATION OF EFFERVESCENT TOOTH FOAMING TABLET:

PRE-COMPRESSION PARAMETERS:

Before compression the flowability properties of granules and powders were characterized by angle of repose, flow rate, bulk density tap density, compressibility index also called Carr's index, percentage porosity, and Hausner's ratio.

The angle of repose:

The angle of repose is defined as the maximum angle possible between the surface of a pile. The angle of repose of powder and the horizontal plane. The angle of repose, a measure of the powder flow attribute, can be used to calculate the frictional force in loose powder or grains.

θ=tan-1(H/R) Where,

θ is the angle of repose

H is the pile's height.

R represents the pile's base radius.

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 which was formed. Care was taken to see that the powder particles slip and roll over each other through the sides of the funnel.[24]

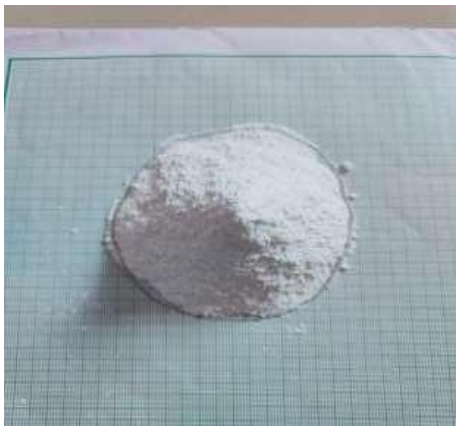

Fig no 6: Angle of repose

Calculation:

Height of the pile: 1.6

Diameter of the circle (D):

D1=6.3 D2=5.8 D3=5.8

Radius of the circle (R): D/2

R1=3.15 R2=2.9 R3=2.9

Average radius=R1+R2+R3 / 3

=8.95 / 3
=2.98

1) Height of the pile taken in this practical (H)=1.6cm
2) Average radius of the circle (R) = 2.98
3) Angle of repose θ = tan-1(H/R)

=tan-1 (1.6/2.98)

=tan-1(0.536)

=28.19°

4) Result = The final angle of repose is **28.19°**.

It is an important flow property for determination of flow of material and the value associated in angle of repose is less than 30° which indicates good flow property in which angle of repose of Effervescent Tooth Foaming Tablet is **28.19°**.

The angle of repose or degrees	Flow property	B1	B2	B3
<25	Excellent	-	-	-
25-30	Good	✓	✓	✓
30-40	Passable	-	-	-
>40	Very poor	-	-	-

Table 4: Angle of repose as an indication of powder flow

Bulk Density:

The bulk density is defined as the ratio of the mass of the powder by the bulk volume in cm. The sample was carefully introduced into a 100 ml graduated measuring cylinder. This cylinder was dropped three times from a height of linch onto a hardwood surface at 2-second intervals. The final volume in cm^3 of the sample contained in the measuring cylinder was then divided by the sample weight in grams to determine the bulk density of each formulation. It was calculated by using the following equation

Bulk density = Mass / Bulk volume

= 14.86/23

= 0.646

It is important parameter for determination of flow characteristics in which the bulk density of Effervescent Tooth Foaming Tablet is **0.646 gm/cm³**

Fig 7: Bulk Density

Tap Density:

The mass of the powder divided by the tapped volume in cm³ is known as the tap density. A graduated measuring cylinder with a capacity of 100 milliliters was carefully filled with the sample. This cylinder was dropped 100 times from a height of linch onto a hardwood surface at 2second intervals. The final tapped volume in cm³ of the sample contained in the measuring cylinder was then divided by the sample weight in grams to determine the tapped density of each formulation. It was calculated by using the following equation

Tap density = Mass / Tap volume

= 14.86 /20

= 0.743

It is important parameter for determination of flow characteristics in which the tap density of effervescent tooth foaming tablet is **0.743 gm/cm³**

Compressibility index Carr's index:

Using bulk densities, Carr's index, also known as the % compressibility index, is an indirect way to measure granule flow. Carr developed it. A powder's percentage compressibility was a direct indicator of the granule stability and possible powder or

bridge strength. Carr's index of each formulation was calculated by using the following equation

$$\% \text{ Compressibility} = \frac{\text{Tap density} - \text{Bulk density}}{\text{Tap density}} * 100$$

$$= \frac{0.743 - 0.646}{0.743} * 100$$

$$= \frac{0.097 * 100}{0.743}$$

$$= 0.1305 * 100$$

$$= 13.05\%$$

The compressibility index is determined on the basis of Tapped density and bulk density and it is important for determination of flow characteristic in which the Compressibility Index is **13.05%**

Sr.no	Compressibility index	Flow	B1	B2	B3
1	5-15	Excellent	-	-	-
2	12-16	Good	✓	✓	✓
3	18-21	Fair to passable	-	-	-
4	23-35	Poor	-	-	-
5	33-38	Very poor	-	-	-
6	>40	Very very poor			

Table 5: Carr's Index as an indication of powder flow

Hausner's ratio:

Hausner's Ratio is a measure of the flowability of a powder, commonly used in pharmaceutical and material science industries. It is calculated using the formula

Hausner's Ratio = Tapped Density / Bulk Density

= 0.743/ 0.646

=1.15

It is important parameter for determination of flow characteristics in which the hausner's ratio of Effervescent Tooth Foaming tablet is **1.15**

Sr. no	Hausner's ratio	Flowability	B1	B2	B3
1	1.00 -1.11	Excellent	-	-	-
2	1.12 -1.18	Good	✓	✓	✓
3	1.19 -1.25	Fair	-	-	-
4	1.26 -1.34	Passable	-	-	-
5	1.35 -1.45	poor	-	-	-
6	1.46 -1.59	Very poor	-	-	-
7	>1.60	Very very poor	-	-	-

Table 6: Hausner's ratio as an indication of powder flow

POST COMPRESSION EVALUATION:

Weight variation:

To determine whether multiple batches of tablets were uniform, weight variation was done. Ten tablets were weighed separately, the average weight was determined, and the weight of each tablet was compared to the average. The tablets pass the test if there are no more than two tablets that deviate from the percentage limit and if none of the tablets differ by more than twice the percentage limit.[25]

Average weight (mg)	Maximum % difference
130 or less	10%

130 - 324	7.5%
> 324	5%

Table 7: Weight variation specification as per I.P.[25]

Weight variation of tablet = Total weight of 10 table / Tablet taken

= 5.35/10

= 0.535

The percentage of weight variation is calculated by using the following formula:

Weight variation = (X/X*)*100

X =Actual weight of the tablet

X* = Average weight of the tablet

Weight variation = (X*/X) × 100

$$= \frac{0.53}{0.535} \times 100$$

= 0.990*100 = 99.0

All 10 Effervescent Tooth Foaming Tablet is passed the weight variation test as per pharmacopoeial limits. The weights of all 20 tablets are uniform and the weight variation.

SR No.	**Weight of tablets (gm)**
1	0.460
2	0.500
3	0.480

4	0.500
5	0.480
6	0.500
7	0.470
8	0.500
9	0.500
10	0.490

Table 8: Weight variation

Hardness:

A Monsanto hardness tester was used to assess the tablet's hardness. It is made up of two plungers and a barrel with a compressible spring. A zero reading was obtained by placing a lower plunger in close proximity to the tablet. The upper plunger was pushed up against a spring until the tablet broke by rotating a threaded bolt. The fracture force was noted. Two tablets of each formulation were evaluated.[26] The hardness is determined by using conventional or digital hardness tester in which the hardness of the Effervescent Tooth**.** Foaming Tablet is **6kg.**

Fig 8: Monsento Hardness Tester

Thickness:

The thickness of the Effervescent Tablet is measured by using a sliding caliper scale, twenty Effervescent Tablets are selected randomly in a holding tray and total crown thickness is measured.[27] Thickness is **0.85mm**

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 dedusted and weighed by the following Formulas[28]

$$\% \text{ friability} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

$$= \frac{5.45 - 5.44}{5.45} \times 100 = 0.18$$

The Friability of Tablet is always less than 1% and the Friability of Effervescent Tooth Foaming Tablet is **0.18.**

Fig 9: Roche's Friabilator

Measurement of effervescence time:

One tablet is kept in a beaker having 200 ml of purified water at 20 °C ± 1. If a clear and transparent solution without any trace of particles is obtained, effervescence time has finished. The average measurement of three formulations was recorded and reported.[29] **Effervescent time = 3 min**

Foamability:

The foamability of 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.[30]

$$\text{Foam expansion} = \frac{\text{Volume of foam}}{\text{Volume of solution}} = \frac{20}{30} = 0.6$$

Fig 10: Foamability of effervescent tooth foaming tablet

pH:

The pH of the solution was measured using a pH meter by dissolving 3 tablets in 3 beakers containing 200 ml of water.[31] **pH=6.2-7.6**

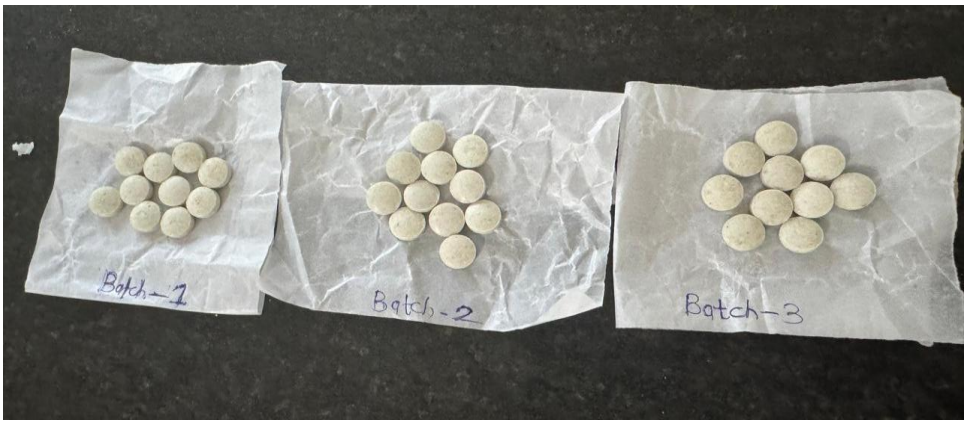

Fig 11: Formulated Tablets

RESULT:

Trial no.	Angle of repose	Bulk density (gm/cm³)	Tap density (gm/cm³)	Carr's index (%)	Hausner's ratio
B1	27.65°	0.589 (gm/cm³)	0.694 (gm/cm³)	15.99%	1.17
B2	26.56°	0.556 (gm/cm³)	0.657 (gm/cm³)	15.37%	1.18
B3	28.19°	0.646 (gm/cm³)	0.743 (gm/cm³)	13.05%	1.15

Table 9: Pre-formulation studies

Post evaluation studies:

Trail No.	Weight variation	Hardness	Thickness	Friability	Measure of Effervescent time	Foamability	pH
B1	70	6 kg	0.85mm	0.9	3min 50 sec	0.3	6.2 -7.6
B2	88.8	5 kg	0.85mm	0.8	3min 22sec	0.4	6.2 -7.6
B3	99.6	6kg	0.85mm	0.18	3 min	0.6	6.2 - 7.6

Table 8: Post evaluation studies

DISCUSSION:

Pre-formulation tests:

The angle of repose:

The angle of repose of the mixture of powder was determined by the fixing funnel method. The formulations B1, B2 showed passable flow B3 is having the minimum angle of repose with good flow property**.**

Carr's index:

Carr's index for the formulation B3 is found to be good. The formulations B1, B2, B3 are having a Carr's index range of less than 15.37% and were found to have good flow property.

Hausner's ratio:

Hausner's ratio for the formulation B3 is found to be good. The formulations B1, B2, B3 are having a Hausner's ratio range of less than 1.18 and were found to have good flow property.

Post formulation:

Weight variation:

All the formulations that are from B1 to B3 have passed the weight variation test as the percentage weight variation was within the I.P limit of ± 5.0 % of the weight. All the tablet weights were found to be consistent with the minimal standard deviation values. The prepared formulations obey the standards of the weight variation test.

Friability:

The minimum friability is 0.18 % for B3. The percentage friability was <1% for all the formulations (B1, B2) ensuring that every tablet was mechanically stable.

pH:

The pH of all the formulations was tested using a pH meter and it was within the limit.

Effervescence time:

The effervescence time for the formulations B1, B2, B3, exceeded the standard effervescence time (< 3minutes) whereas the formulation B3 showed the effervescence time of **3 min** which is less than the standard effervescence time.

Foaming ability:

The foaming ability for the formulation B1 was fair whereas, for the formation B2, B3 have a good foaming property.

Hardness:

Using the Monsanto hardness tester, the hardness of each formulation was examined, and all of them fell inside the acceptable range

CONCLUSION:

The present research work entitled “FORMULATION AND EVALUATION OF EFFERVESCENT TOOTHPASTE TABLETS" was carried out to replace the traditional toothpaste that we have used from the early years. Toothpaste tablets are chewable versions of toothpaste which are able to be broken down into paste before brushing. The effervescent toothpaste tablets were made using direct compression process in 500 mg dose. Pre-compression studies like angle of repose, tap density, bulk density, compressibility index, Hausner's ratio, flow rate were conducted on the powder blend. Weight variation, hardness, friability, wettability, pH, effervescence duration, carbon dioxide content, and foaming ability were among the post-compression tests used to assess the prepared tablets. The results obtained at each stage of the formulation were utilized and the best formulations were selected. Finally, the B3 formulation of 500mg tablets was selected as the best formulation because of their physicochemical characteristics.We concluded that the formulated effervescent toothpaste tablets can be significantly used as an ecofriendly alternative for traditional toothpaste.

FUTURE SCOPE

1. **Clinical Trials and ADA Approval:** To assess the long-term effectiveness, safety, and user acceptance of effervescent toothpaste pills, more clinical research is necessary. Credibility and adoption will increase as a result of receiving acceptance from dental bodies such as the American Dental Association (ADA).
2. **Adding Therapeutic Agents:** To target particular oral problems like caries, sensitivity, or gingivitis, the formulation can be improved to incorporate therapeutic agents like xylitol, fluoride, or herbal extracts.

3. **Customisation and Personalisation:** To provide a more individualised oral care experience, tablets can be made with different flavours, whitening agents, or active components based on individual needs.
4. **Market Expansion and Awareness:** By raising public awareness and facilitating accessibility through retail and e-commerce channels, the product can become a more feasible substitute for traditional toothpaste.
5. **Sustainability and Environmental Impact:** In line with international sustainability goals, these tablets can greatly reduce the amount of plastic waste produced by conventional toothpaste tubes as environmental awareness grows.
6. **Global Adaptability:** These tablets' water-free and portable design makes them especially useful in disaster assistance, low-resource environments, and military or space applications, offering chances for cooperation between the public and private sectors.

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