FORMULATION AND EVUALATION OF HERBAL EFFERVESCENT TOOTHPASTE TABLET.

Krisha H Mirani[1*], Mukesh T Mohite[2], Anmol Divedi[3], Sai Bapat[4]

Abstract:
Toothpaste plays a crucial role in maintaining oral hygiene and preventing dental diseases. In recent years, there has a been a growing interest in natural and herbal alternatives to conventional toothpaste formulations. The Herbal effervescent toothpaste tablet represents a breakthrough in oral care technology, providing a novel and convenient approach to oral hygiene. The tablet is formulated to dissolve quickly in the mouth, releasing a refreshing effervescence and a burst of herbal ingredients, including carefully selected natural extracts and essential oils known for their oral health benefits.

With precise dosing, travel – friendly size and enhanced cleaning efficacy, this tablet offers a convenient and effective solution for maintaining optimal oral hygiene. Its herbal ingredients provide natural anti-bacterial and anti-inflammatory properties aiding in gum diseases prevention and promoting overall oral health.

Additionally, the tablets effervescent action helps to remove plaque, bad breath and provide a refreshing sensation, enhancing the overall cleanliness and freshness of the mouth. Its unique formulation combines the benefits of herbal ingredients with ease of effervescent tablet, providing a refreshing and effective oral care experience. The product has the potential to revolutionize the way individuals approach their daily oral care routine, offering natural and convenient alternatives to traditional toothpaste formulations.

Keywords: Toothpaste, Oral hygiene, Herbal effervescent toothpaste tablet, Natural alternatives

[1*]Student at Dr. D. Y. Patil College of Pharmacy, Akurdi, Pune, 411044, India.
[2]Faculty at Dr. D. Y. Patil College of Pharmacy, Akurdi, Pune, 411044, India
[3]Student at Dr. D. Y. Patil College of Pharmacy, Akurdi, Pune, 411044, India.
[4]Student at Dr. D. Y. Patil College of Pharmacy, Akurdi, Pune, 411044, India.

***Corresponding Author:** Krisha H Mirani
[*]M.Pharm, Department of Quality Assurance, Student at Dr. D. Y. Patil College of Pharmacy, Akurdi, Pune, 411044, India., Email ID: miranikrisha@gmail.com, Mob No: 9096103044

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1. INTRODUCTION:

Oral cleanliness is the act of brushing (dental cleanliness) and cleaning between the teeth consistently to keep up with one's mouth clean and unfettered from illness and different issues (like foul breath). Oral cleanliness ought to be drilled consistently to stay away from tooth infection and unfortunate breath. Tooth rot (pits, dental caries) and gum issues, like gum disease and periodontitis, are the most successive sorts of dental problems. Brushing two times every day is suggested, yet preferably, the mouth ought to be cleaned after every dinner. Interdental cleaning is similarly basically as significant as tooth brushing with regards to cleaning between the teeth. This is on the grounds that a toothbrush can't arrive between the teeth and thus just eliminates around half of the plaque on the surface.

Dental caries is the commonly used word for tooth decay. This occurs as a result of plaque bacteria in the mouth converting carbohydrates into acid. After that, the acid damages the teeth. While decay can develop on any surface, it most frequently happens in the fissures and hollows on the biting surfaces of teeth as well as in the spaces in between teeth where food likes to gather and bacteria can grow.

It is a complex, progressive condition in which a tooth's surface structure deteriorates over time. This is brought on by the hydroxyapatite's irreversible solubilization by the acids generated by the bacteria during their metabolic processes. Increased uses of sugary meals and beverages as well as persistently bad oral hygiene worsen this. The start of dental caries does not happen suddenly. [1, 2]

STAGES OF DENTAL CARIES:

1. Apart from the white spot lesions (WSL) visible on the enamel surface, there are no symptoms in the early stages of tooth decay. These specific WSLs develop on the smooth surfaces of the teeth as a result of underlying enamel demineralization. These lesions develop when plaque that has accumulated on the surface and has not been disturbed for a long time is exposed to prolonged exposure. The enamel surface becomes demineralized and decalcified when it is exposed to the acids that the plaque bacteria produce. At pH 5 to 6, tooth enamel begins to demineralize.
2. As a result of persistent demineralization, the enamel begins to deteriorate in the second stage. The likelihood of the tooth's surface breaking up due to enamel degradation, which would result in permanent harm, is increased.
3. As the enamel layer is compromised at this time, dentin hypersensitivity begins to emerge. The tooth may shatter and dentin decay will begin if the enamel decay is not prevented. When this stage is achieved, the person's discomfort will become more intense, and their sensitivity to stimuli will rise. When acid attacks the enamel, tooth decay sets in. Usually, the only way to identify early-stage decay that appears between teeth is by using radiography.
4. When decay reaches the tooth's delicate pulp in the third stage, the nerve becomes damaged, and extremes of heat and cold will hurt. Microorganisms that penetrate the dentin cause an inflammatory reaction that, if left untreated, can result in recurrent episodes that permanently destroy normal tissue while also diminishing the body's capacity to heal itself. Blood vessels and nerves begin to perish as a result of bacteria expanding the root canals, and exudate begins to develop.
5. The infection may spread throughout the pulp at this point, leading to the development of an abscess. The tooth may need to be pulled because this is quite painful.
6. If still left untreated, it will result in tooth loss.[3,4]

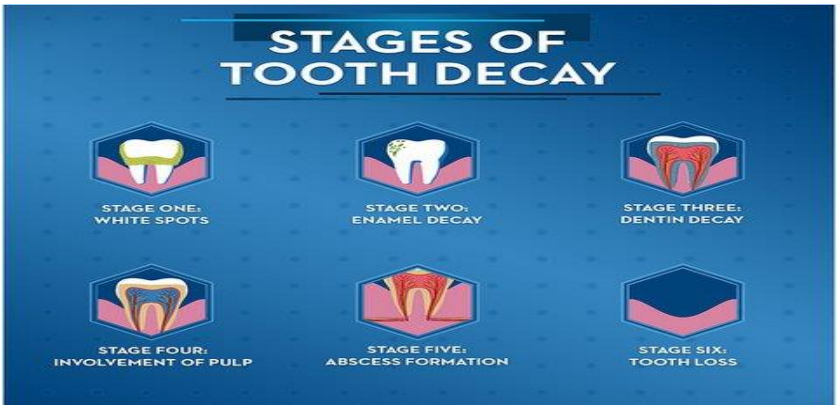


Fig 1: Stages of Tooth Decay

CONCEPT OF TOOTHPASTE TABLETS:

The paste that we have all used since we were kids is now available in tablet form. Alternatives that are all-natural and suitable for vegans are available, and the pills froth and disintegrate as you brush (no water is needed). The tablets may be packaged in recyclable materials or reused jars. There are no sticky pastes, yet it has the same cleansing advantages as toothpaste. Preservatives paraben and sodium benzoates are used in toothpaste to prevent drying and to give it a creamy feel, which is not necessary for toothpaste tablets. These are safe and environmentally friendly since they are dry and contain little to no preservatives. They have a minimal carbon impact since they are easy to carry in tablet form.

Over time, toothpaste tubes degrade into micro plastics, endangering the environment as well as the health of people and animals. Therefore, toothpaste pills are becoming a useful fix. The effects of toothpaste tablets, which are little, bite-sized chewable that may be digested into a paste before brushing, are more effective and environment friendly than those of regular toothpaste.

Toothpaste tablets employ ingredients found in toothpaste, such as xylitol, calcium carbonate, sodium bicarbonate, and derivatives of tartaric acid. They are tightly packaged, much like medicine tablets. These can last a long time if stored properly. Toothpaste tablets that are incorporated with more of natural ingredients that provide strength and nutrients to fight against dental problems are widely accepted. Use of natural source from plants such as Syzygium aromaticum and Mimusops elengi provide extensive help to fight against the germs present in the oral cavity. [5, 6]

Scientific classification:

a) Syzygium Aromaticum (Clove)

Kingdom	**Plantae**
Sub-kingdom	Tracheobionta
Super-division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Genus	Syzygium
Species	aromaticum

b) Mimusops Elengi (Bakul)

Kingdom	**Plantae**
Sub-kingdom	Tracheobionta
Super-division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Ericales
Family	Sapotaceae
Genus	Mimusops
Species	elengi

MATERIALS & METHODS:

❖ **List of Material Used:**

Table 1: Detail of Materials used

Sr. no.	**Material**	**Supplier**
1	Syzygium aromaticum	Amsar private limited
2	Mimusops elengi	Amsar private limited
3	Citric Acid	Analab fine chemicals, Mumbai.
4	Tartaric Acid	Analab fine chemicals, Mumbai.
5	Sodium Carbonate	Analab fine chemicals, Mumbai.
6	Sodium Lauryl Sulphate	Analab fine chemicals, Mumbai.
7	Sodium Bicarbonate	Analab fine chemicals, Mumbai.
8	Sodium Citrate	Analab fine chemicals, Mumbai.
9	PVP K 30	Analab fine chemicals, Mumbai.
10	Sodium Saccharin	Analab fine chemicals, Mumbai.
11	Calcium Carbonate	Analab fine chemicals, Mumbai.

INSTRUMENTS

❖ **List of Instruments Used:**

Table 2: Detail of Instruments used

Sr. No.	Instrument	Models and manufactures
1.	UV Spectrophotometer	Shimadzu 1900i, Japan
2.	FTIR Spectrophotometer	Shimadzu, Japan
3.	Digital Balance	LCGC Radwag, Hyderabad
4.	Stability Chamber	Biomedia, Pune
5.	Sonicator	Biomedia LX300
6.	Tablet compression Machine	Labtronics LT-115, Mumbai
7.	pH Meter	Euiptronics EQ614, Mumbai
8.	Disintegration Apparatus	Anjay Engitech New-Delhi
9.	Dissolution Apparatus	Testo India Private Limited
10.	Friability Apparatus	Thermo Scientific, Mumbai

Method Of Preparation Of Toothpaste Tablet

Herbal toothpaste tablets are formulated using direct compression technique all the ingredients present in the formulation table were weighed accurately and blended in mortar –pestle to form homogenous mixture. These were passed through the sieve to get uniformed size particle. These are then compressed by direct compression method using 6-mm bi-concave punches on a Double Rotary Tablet Compression Machine (Rimek 10 station minipress). Batches F1 to F13 were formulated. [8]

COMPOSITION OF TOOTHPASTE TABLET

Table No 3: Batches with Composition of Herbal Effervescent Toothpaste Tablet using Central Composite Design.

INGREDIENT	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
Syzygium aromaticum extract	125	125	125	125	125	125	125	125	125	125	125	125	125
Mimusops elengi extract	125	125	125	125	125	125	125	125	125	125	125	125	125
Citric Acid	105	105	105	105	105	105	105	105	105	105	105	105	105
Tartaric Acid	190	190	190	190	190	190	190	190	190	190	190	190	190
Sodium Carbonate	20	20	20	20	20	20	20	20	20	20	20	20	20
Sodium Lauryl Sulphate	1.5	1.5	1.5	1	2.2071	2	1.5	2	1.5	1.5	1	0.7928	1.5
Sodium Bicarbonate	338.787	360	360	375	360	375	381.23	345	360	360	345	360	360
Sodium Citrate	25	25	25	25	25	25	25	25	25	25	25	25	25
PVP K 30	5	5	5	5	5	5	5	5	5	5	5	5	5
Sodium Saccharin	5	5	5	5	5	5	5	5	5	5	5	5	5
Calcium Carbonate	15	15	15	15	15	15	15	15	15	15	15	15	15

1. Evaluation Of Toothpaste Tablets

• PRE-COMPRESSION PARAMETERS [10]

a. Angle of repose (θ): The angle of repose is defined as the highest achievable angle between the surface of a powder pile and the horizontal plane. The angle of repose may be used to calculate the frictional force in a loose powder or particles. It represents the flow qualities of the powder. tan = H/R = tan-1 (H/R). The powder combination was permitted to pass through a funnel attached to a stand at a specific height (H) $Tan\ \theta$ = h/r

b. Bulk Density: The bulk density was calculated by dividing a powder's mass by its bulk volume in cm3. The volume of the powder was calculated without moving the cylinder, and the bulk density was calculated using the equation. Bulk density (BD) = (Weight of Powder/ (Bulk Volume)

c. Tapped density: An adequately weighed sample of powder was placed in a 25ml measuring cylinder. A standard method was used to determine the density of the tapped material using a digital bulk density the instrument. The tapped density was then calculated using the equation and the final volume. Tapped density (TD) = (Weight of Powder)/(Tapped Volume)

d. Carr's Index: Carr's index is widely used for evaluating flowability. Carr's index values between 5-15% are regarded excellent and adequate up to 21%, while values more than 23% indicate poor flow. It is computed using the equation. Carr's Index = (Tapped Density-Bulk Density)/(Tapped Density) ×100

e. Hausner's ratio: The Hausner's ratio indicates the flowability of powder. A Hausner's ratio of less than 1.25 suggests that the flow is good. The equation calculates it. Hausner's ratio = (Tapped Density)/(Bulk Density)

f.Moisture content: Three desiccators are made with saturated salt solutions of sodium chloride

(71% RH for creation at 18 °C), potassium nitrate (for creation at 60% RH at 18 °C), and sodium nitrite (for creation at 90% RH for creation at 18 °C). Each formulation's three pills are put in desiccators. The Karl Fischer technique and an auto titrator device are then used to determine the equilibrium moisture content on the first day and seven days afterwards.

• **Post Compression Parameters [12]**

a. Organoleptic Properties: These include the outer appearance of the tablet such as shape, size, color, odor etc.

b. Weight Variation: Weight Variation: The weight variation was carried out by weighing 20 randomly selected sublingual tablets from each batch. The average weight was calculated and compared with the individual sublingual tablet weights.

c. Thickness: A Digital Vernier Calliper was used to measure the thickness of each of the ten tablets that were randomly chosen from each batch.

d. Hardness: The Monsanto Hardness Tester was used to gauge how hard each formulation's tablet was. The hardness was expressed in kg/cm2 units.

e. Friability: Using the Roche friabilator, the tablet's friability was assessed. In a plastic container that rotates at 25 revolutions per minute and drops a tablet from a height of 6 inches with each revolution, this gadget treats the tablet to the combined effects of abrasion and shock. 0.5 to 1% is the USP limit.

f. Determination of effervescent solution pH: Immediately following the completion of the dissolution, the pH of the solution was measured using a pH metre with one tablet in 200 ml of filtered water at 20 1 °C.

g. Measurement of CO2 content: One effervescent tablet solved in 100 ml of 1N sulphuric acid solution and weight changes were determined after dissolution end.

h. In-Vitro disintegration time: Disintegration is the term for the breakdown of a tablet into smaller components. Using a disintegration test device with a mesh aperture of 2mm, that performs approximately 28–32 cycles/min and maintains water temperature at 37–2°, the in-vitro disintegration time of a tablet was calculated.

i. In-Vitro release study: Using the USP Dissolution Testing Apparatus II (Paddle type), the rate of release of toothpaste tablets from effervescent tablets was calculated. Phosphate buffer with a pH of 6.8 in 900 ml of dissolving media that was kept at 37°C. Throughout the investigation, the paddle speed was maintained at 50 rpm. Every five minutes, one ml of samples was taken out, diluted to a volume of ten ml, and then one ml of new dissolving medium kept at the same temperature was implanted. At 245 nm, the materials were spectrophotometrically examined with phosphate buffer pH 6.8 serving as the blank.

RESULTS AND DISCUSSION

Standard Calibration curve:

The standard calibration curve for Syzygium aromaticum and Mimusops elengi were drawn by plotting absorbance v/s concentration. Maximum wavelength of Syzygium aromaticum was found to be 250 nm and for Mimusops elengi it was found to be at 275nm. The absorbance values are given in Table 3 and 4. The standard calibration curve for both of the extracts is shown in fig 2 and 3 respectively.

Table no 4. Absorbance value of Syzygium aromaticum at 250nm.

Sr.No.	Concentration (µg/ml)	Absorbance
1	0	0
2	2	0.2057
3	4	0.331
4	6	0.5079
5	8	0.6644
6	10	0.8432

Figure no 2: Calibration curve of Syzygium aromaticum

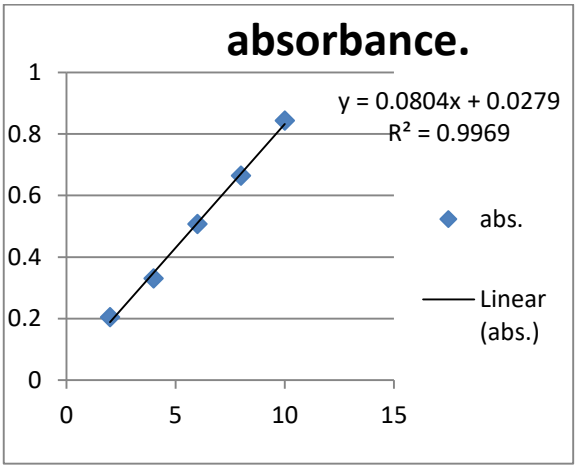


Table no 5. Absorbance value of Mimusops elengi at 249nm.

Sr.No.	Concentration (µg/ml)	Absorbance
1	0	0
2	2	0.1769
3	4	0.3469
4	6	0.5337
5	8	0.7537
6	10	0.9656

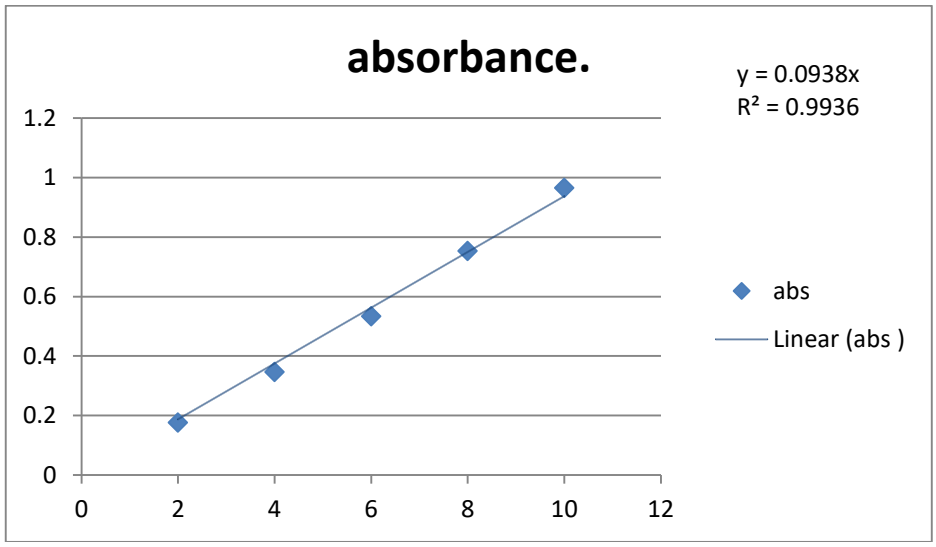


Figure no 3: Calibration curve of Mimusops elengi.

FTIR analysis: FT-IR was used to research how well pharmacological excipients work together. FT-IR studies were carried out for the combination excipients and the pure medication. An FT-IR spectrophotometer was used to scan the drug purity from 4000 cm-1 to 400 cm-1.

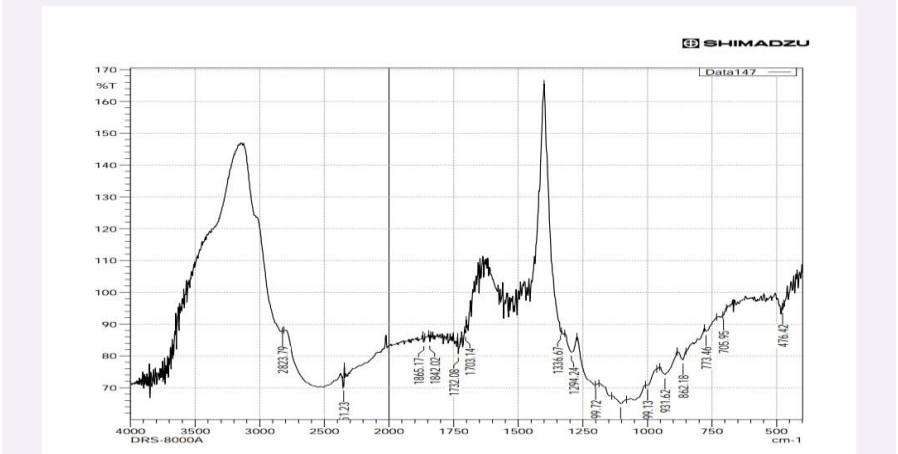


Figure no 4: FTIR spectrum of Syzygium aromaticum

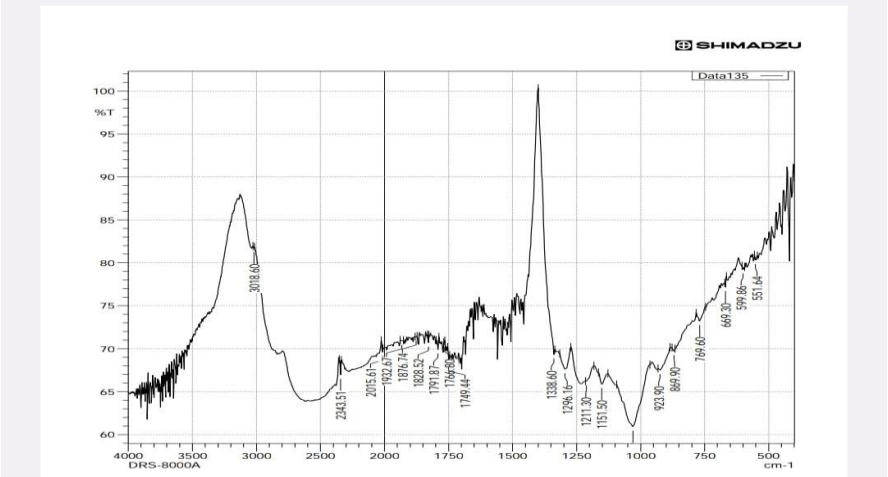


Figure no 5: FTIR spectrum of Mimusops elengi.

DSC Studies: The physical condition of both drug extracts was described using differential scanning calorimetry. Samples were weighed accurately to 0.005 mg (3-5 mg), then placed in aluminium pans with the lids secured using a crimper. At a scanning rate of 10 °C min-1, the sample's thermal characteristics were examined across the temperature range of 40-300 °C.

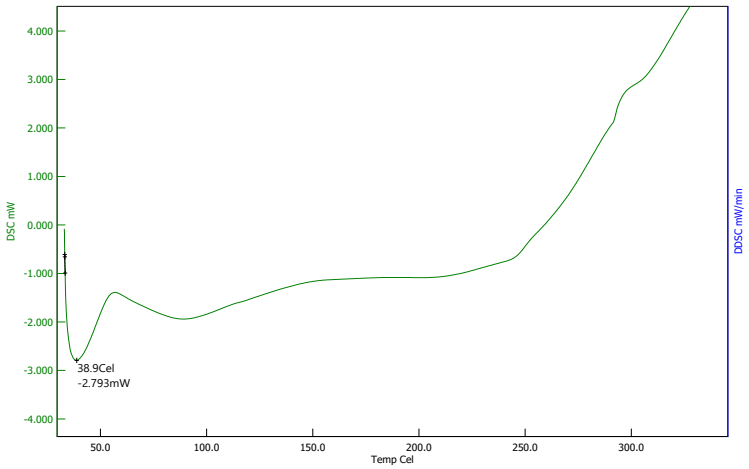


Figure no 6: DSC of Syzygium aromaticum

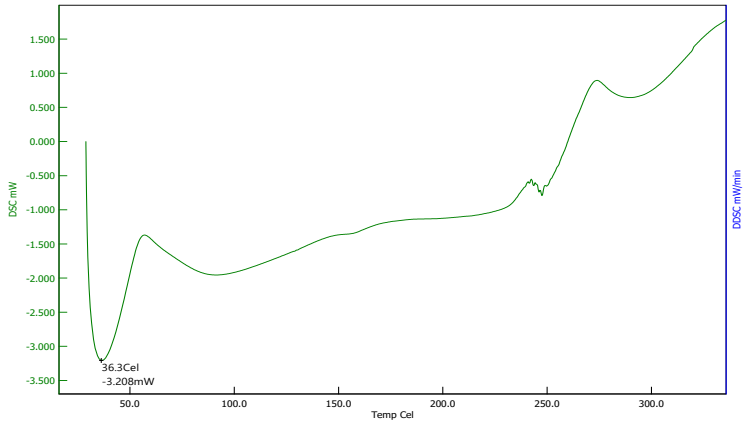


Figure no 7: DSC of Mimusops elengi.

HPTLC analysis of extracts:

- **HPTLC analysis of Syzygium aromaticum extract**

Sample Preparation: Weighed 100 mg of extract sample, dissolved in 10 ml of MeOH, sonicated for 30 mins, centrifuged at 10000 rpm for 15 mins and supernatant was filtered and used for spotting.

Mobile phase: a) chloroform:methanol:formic acid (5:4:1 v/v/v)
Stationary phase: Silica Gel 60 F254 (Merck)
Saturation time: 20 mins
Spotting volume: 2, 5 µL
Visualization image: a) Track 1, 2 – white light, Track 3, 4– UV 254 nm, Track – 5,6 – UV 366 nm.

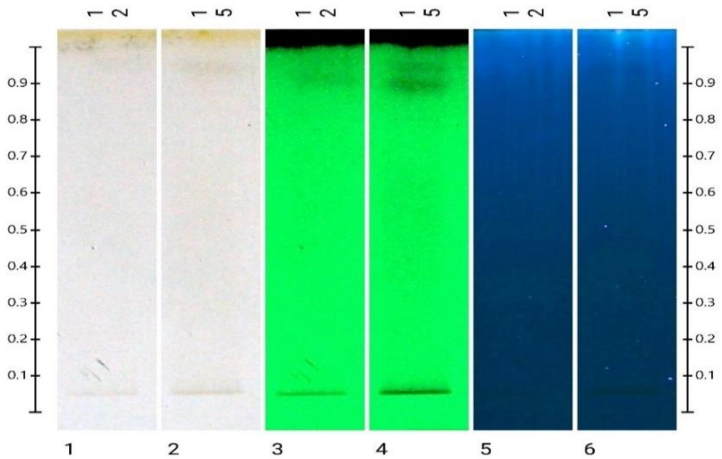


Figure no 8: Visualization image of Syzygium aromaticum extract at track 1,2 – white light, Track 3,4– UV 254 nm, Track – 5,6 – UV 366 nm.

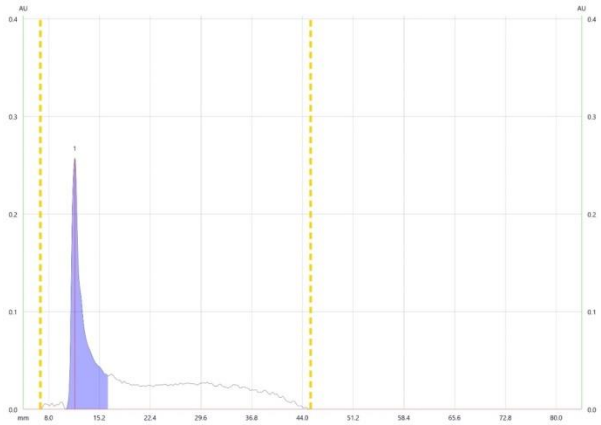


Figure no 9: Densitogram of Syzygium aromaticum extract

HPTLC analysis of Mimusops elengi extract:
Sample Preparation: Weighed 100 mg of extract sample, dissolved in 10 ml of MeOH, sonicated for 30 mins, centrifuged at 10000 rpm for 15 mins and supernatant was filtered and used for spotting.
Mobile phase: a) chloroform:methanol:glacial acetic acid (9:1:0.1 v/v/v)
Stationary phase: Silica Gel 60 F254 (Merck)
Saturation time: 20 mins
Spotting volume: 2, 5 µL
Visualization image: a) Track 1,2 – white light, Track 3,4– UV 254 nm, Track – 5,6 – UV 366 nm.

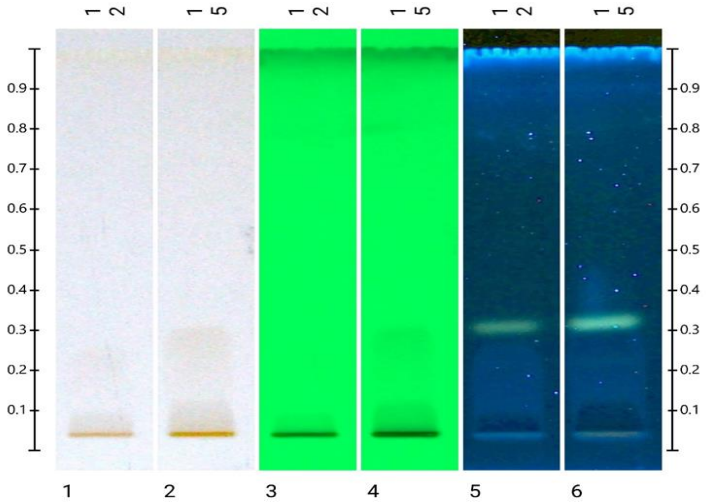


Figure no 10: Visualization image at Mimusops elengi track 1,2 – white light, Track 3,4– UV 254 nm, Track – 5,6 – UV 366 nm.

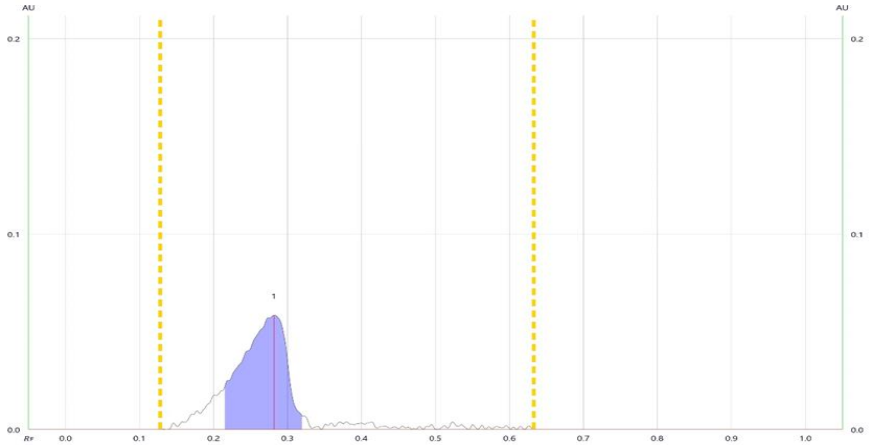


Figure no 11: Densitogram of Mimusops elengi

Organoleptic Results:

Characteristics	**Observation**
Appearance	Characteristic
Color	Lightest-Brown
Odor	Odorless
Shape	Circular
Size	1.4mm

Pre formulation Results

Batch no.	Angle of Repose (θ)	Bulk Density (g/cm3)	Tapped Density (g/cm3)	Carr's Index (%)	Hausner's Ratio	Moisture Content (%)
1	29.43 ±0.40	0.81±0.01	0.89±0.01	8.27±0.125	1.09±0.01	1.30±0.05
2	29.57 ± 0.35	0.78±0.01	0.88±0.01	11.36±1.07	1.13±0.01	1.31±0.03
3	32.40 ±0.44	0.85±0.01	0.95±0.01	10.87±1.12	1.12±0.01	1.33±0.04
4	33.50 ±0.40	0.87±0.01	0.99±0.01	11.82±1.49	1.13±0.02	1.22±0.09
5	34.50 ±0.40	0.74±0.01	0.85±0.01	13.28±0.73	1.15±0.01	1.56±0.04
6	29.60 ±0.44	0.76±0.01	0.84±0.01	9.12±0.60	1.10±0.01	1.12±0.09
7	34.47 ±1.01	0.83±0.01	0.91±0.01	9.15±1.58	1.10±0.01	1.56±0.04
8	29.53 ±0.25	0.74±0.01	0.86±0.01	13.23±0.63	1.15±0.01	1.24±0.04
9	**27.80 ±1.80**	**0.55±0.01**	**0.65±0.01**	**15.38±0.63**	**1.16±0.01**	**1.12±0.02**
10	28.30 ±0.44	0.72±0.01	0.88±0.01	9.08±1.89	1.10±0.01	1.24±0.05
11	29.60 ±0.35	0.75±0.01	0.90±0.01	12.21±1.12	1.12±0.01	1.53±0.02
12	31.43 ±0.25	0.88±0.01	0.92±0.01	10.42±1.12	1.11±0.01	1.25±0.02
13	28.82 ±0.44	0.82±0.01	0.87±0.01	11.15±0.73	1.14±0.01	1.52±0.03

Post Compression Results

Batch No.	**Weight variation(mg)**	**Hardness (Kg/cm2)**	**Disintegration Time (sec)**	**CO2 Content (mg)**	**Friability**	**PH observed**
1	1002.42±3.79	5.27±0.21	204.0±3.61	229.33±1.53	0.91	6.25±0.1
2	1008.50±2.89	5.50±0.40	183.33±2.89	221.33±2.08	0.55	5.95±0.01
3	1009.52± 289	6.17±0.06	227.0±2.0	228.0±2.0	0.85	6.03±0.02
4	1004.32±3.51	5.90±0.20	246.67±2.08	276.0±1.73	0.92	6.69±0.01
5	1003.23±3.51	5.33±0.21	167.33±2.08	288.67±3.21	0.93	6.25±0.01
6	1007.40±3.51	6.02±0.10	120.33±2.08	280.67±0.58	0.92	5.50±0.02
7	1006.45±2.61	5.50±0.40	152.0±2.65	280.67±0.58	0.90	6.63±0.02
8	1010.22±1.53	5.50±0.40	203.0±2.65	303.22±2.0	0.94	6.13±0.02
9	**1000.40±1.52**	**4.80±0.38**	**110.20±3.06**	**327.0±2.0**	**0.95**	**6.48±0.24**
10	1010.52±4.04	5.57±0.21	252.67±3.06	256.88±3.21	0.93	6.32±0.24
11	1011.32±4.04	6.21±0.06	254.37±3.61	295.67±2.08	0.85	6.07±0.01
12	1014.50±4.23	5.25±0.21	304.25±2.0	242.33±2.08	0.90	5.23±0.24
13	1015.52±2.65	6.20±0.38	221.23±2.08	252.45±2.0	0.92	6.12±0.02

Formulation Optimization Using Central Composite Design:

Central Composite Design (CCD) is a popular experimental design method for optimising and evaluating a system's response by effectively exploring the design space.

The following independent variables were chosen:

X1: Concentration of SLS

X2: Concentration of Sodium Bicarbonate

The following non-independent variables were chosen:

Y1: % Drug release of drug extract 1

Y2:% Drug release of drug extract 2

And Foaming Index

The Central Composite Design (CCD) for the following dependent and independent variables required 13 cycles from F1 to F13.

The dependent factors are measured or observed throughout the experimental runs, and the data obtained is processed to evaluate the impact of the independent factors on the response variables. Regression analysis, ANOVA, and response surface methodology (RSM) are examples of statistical approaches.

Table 9: Responses of Formulation using Central Composite Design

Batch No.	X1:Concentration of SLS	X2:Concentration of Sodium Bicarbonate	Y1:%Drug Release 1	Y1:%Drug Release 2	Foaming Index
1	1.5	338.787	91.57	85.2	1.7
2	1.5	360	94.29	88.45	1.7
3	1.5	360	94.29	88.45	1.7
4	1	375	95.62	89.23	1.4
5	2.20711	360	94.29	88.45	2.1
6	2	375	95.62	89.23	1.9
7	1.5	381.213	96.22	90.45	1.7
8	2	345	92.4	86.35	1.9
9	**1.5**	**360**	**94.29**	**88.45**	**1.7**
10	1.5	360	94.29	88.45	1.7
11	1	345	92.4	86.35	1.4
12	0.792893	360	94.29	88.45	1.1
13	1.5	360	94.29	88.45	1.7

Advantages of Experimental Design (Central Composite Design) for Herbal Conventional Tablet:

The use of Central Composite Design (CCD) in the formulation of herbal effervescent toothpaste tablet provides a complete strategy to optimizing and studying the tablet composition. Here are some examples of CCD applications in this context:

1. % Drug Release Assessment: CCD facilitates it easier to evaluate % drug release as an independent component. The percentage of drug release refers to the quantity of drug released from the tablet during a given time period. CCD aids in establishing the link between % drug release and formulation factors, allowing the formulation to be optimized to produce the desired drug release profile.
2. Foaming index assessment: CCD facilitates to evaluate the foaming index of formulated effervescent toothpaste tablet as an independent component. The foaming index refers to the ability of formation of foam to help in the cleaning process of teeth. This allows the formulation to be optimized to produce the desired foaming index.
3. Response Surface Modeling: CCD enables the building of response surface models to better understand the link between formulation factors (% drug release of extracts and foaming index) and tablet attributes. These models give insight into the influence of each element and their interconnections, allowing formulation scientists to make educated judgments about formulation optimization.
4. Design Space Determination: CCD assists in determining the design space, which is the range of values for the formulation factors that provides the intended tablet qualities. CCD assists in establishing the design space for the herbal traditional tablet formulation by examining the response surface and determining the best area.

% DRUG RELEASE

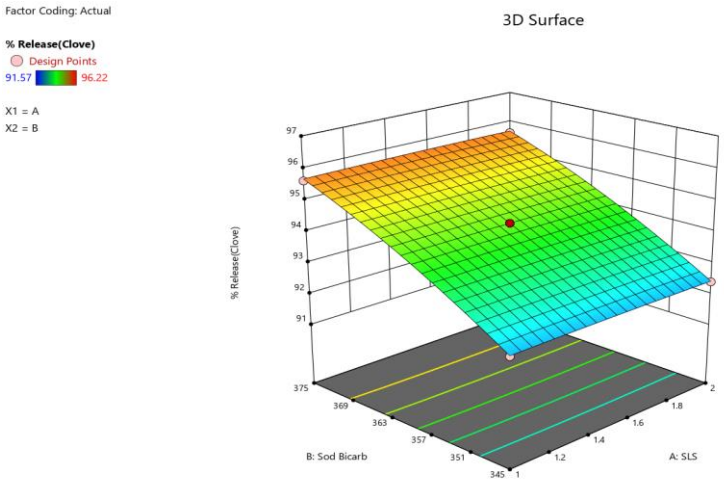
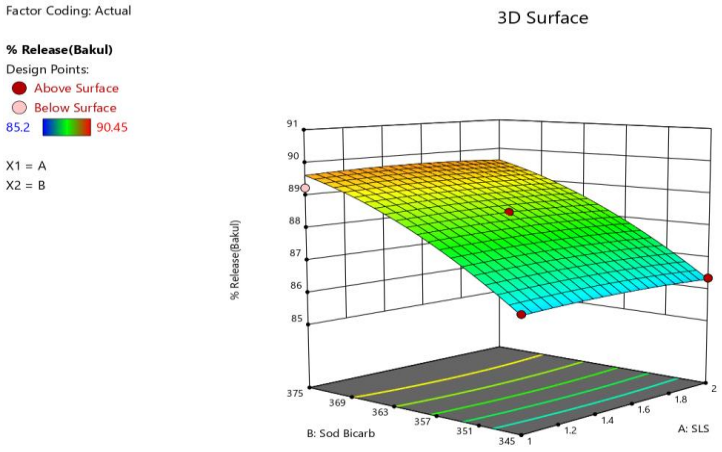


Figure No .7: 3D Surface Graph of Drug Release

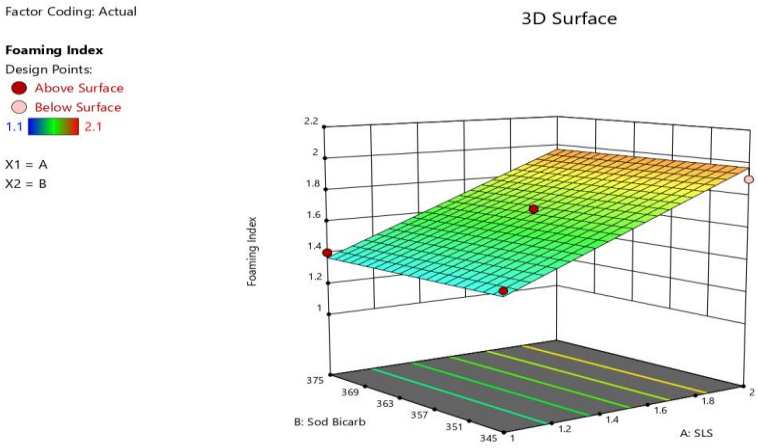
Response	P-value	F-value	R^2	Predicted R^2 value	Remark
%Drug Release	0.0001	1890.56	0.9993	0.9947	Significant

% DRUG RELEASE



Response	P-value	F-value	R^2	Predicted R^2 value	Remark
%Drug Release	0.0001	54.41	0.9749	0.8216	Significant

FOAMING INDEX



Response	P-value	F-value	R^2	Predicted R^2 value	Remark
%Drug Release	0.0001	93.07	0.9490	0.8938	Significant

CONCLUSION:

Advancement in the oral hygiene was promoted by formulating an effervescent toothpaste tablet. Among all the formulations, B9 gave optimized and good results with respect to drug release and foaming index. It also showed significant responses with rest to preformulation and post formulation evaluation test. The batch F9 was considered the optimized batch with 94.29% and 88.45% drug release and with 1.7 foaming index. In conclusion, it can be cleared that a stable and effective effervescent tablet was formulated which ease the oral cleaning with good can feel of effervescence in the oral cavity and hence helps in fighting with germs along with the use of natural ingredients.

CONFLICT OF INTREST: The authors have no conflicts of interest regarding this investigation.

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