



# Development & Characterization of herbal toothpaste for Dentin hypersensitivity

Prerana Sahu<sup>1,3</sup>, Divyansh Sahu<sup>2</sup>, Tanuj Pandey<sup>1</sup>, Ayush Dubey<sup>2</sup>, Harish Sharma<sup>2</sup>, Gyanesh Kumar Sahu<sup>2</sup>

1. Rungta Institute of Pharmaceutical Sciences, India

2. Rungta Institute of Pharmaceutical Sciences and Research, India

3. Rungta College of Pharmaceutical Sciences and Research, India

## Corresponding Author:

Prerana Sahu

Assistant Professor

Rungta Institute of Pharmaceutical Sciences, Bhilai

## **Abstract:**

The oral disease, and oral cavity those are problem in worldwide and therefore beneficial reduced by using herbal toothpaste and they gives no side effect compaire with other marketed product. Recently herbal toothpaste are increasing demand worldwide because these are less side effect and beneficial to for oral cavity and tooth decay. Clove herbal extract and other ingredients, including calcium carbonate, sodium lauryl sulphate, glycerin, gum tragacanth, water, saccharin, flavouring, and preservative, are used to make herbal toothpaste. The herbal extract provides antibacterial and anti-inflammatory activity, reduces dental caries, prevents tooth decay, delivers mouth freshness, and aids in improving dentin hypersensitivity. The formulated herbal toothpaste gives beneficial action and safety. The observation are found to be from physical examination appearance, spread ability, viscosity, pH, homogeneity, foam ability, determination of moisture content and cleaning ability. The herbal toothpaste has no side effect and they prevent dental caries and dental disease.

**Keywords:** dentin hypersensitivity, clove, tooth decay, tooth carries.

## **1. Introduction:**

The most common oral and dental issues in various countries are inflammation of tooth surrounding tissue and halitosis. The inflammation is caused by bacteria that consume food debris accumulated on the tooth surface, especially on the cervical tooth area, and break it down into sugars and acids that irritate the tooth surrounding tissue. Furthermore, inflammation lowers the gingival margins and deforms the periodontal pockets, leading to alveolar bone resorption, opening the cementum layer, and eventually causing tooth loss. Pathological conditions such as periodontitis can be caused by focal infections, affecting many vital systems, such as the cardiovascular and renal systems. [1]

*P. aeruginosa* is one of the most serious opportunistic bacteria and is responsible for 10–20% of nosocomial infection. It can cause burn infections, urinary tract infections and cystic fibrosis. Its high propensity for persistent infection, particularly in immuno impaired individuals, is ascribed to a number of virulence factors, biofilm development, and innate and acquired antibiotic resistance. [2]

Spices as clove, oregano, mint, thyme and cinnamon, have been working for centuries as food preservatives and as medicinal plants mainly due to its antioxidant and antimicrobial activities. Now a day, many reports confirm the antibacterial, antifungal, antiviral and anticarcinogenic properties of spice plants. Due to its powerful antioxidant and antibacterial properties that set it apart from other spices, clove has attracted a lot of attention. [3]

Dentin hypersensitivity (DH) is a major health care problem affecting both younger and older populations. It is characterized by a short, sharp pain of unexplained reason that might occur in response to chemical (e.g., excessive acidic drinks or bleaching) or mechanical factors (e.g., vigorous tooth brushing). In older population, DH can be associated with root exposure especially after periodontal treatment. [4]

### 1.1 Clove:

Clove consists of the dried flower buds of *Eugenia caryophyllus* Thumb, belonging to family Myrtaceae. *Eugenia Caryophyllus*. A component distilled from the dried flower buds of *Eugenia caryophyllus* Also known as clove oil. Cloves, also known as *Eugenia Caryophyllus*, were traditionally used as a cure for diarrhoea, intestinal worms, and other digestive disorders because of their strong anti-microbial effects against fungi and bacteria. [5] These anti-microbial properties also explain its use in deodorants and anti-fungal powders. Japanese researchers have reportedly found that *Eugenia Caryophyllus* includes antioxidant qualities that assist prevent the cell spoilage that eventually leads to malignant illness. However, the chemical eugenol has been found to be a weak tumor promoter, making this element one of many remedial herbs with both pro- and anti-cancer effects. [6]



Figure 1.1: Clove

Cloves are the pink flowering bud of a form evergreen tree (*Eugenia aromatica*), which are dried until brown and used for medicinal and spicing purposes. Indigenous to the Moluccas spice islands of Indonesia, cloves also grow naturally in India, the West Indies, Tanzania, SriLanka, Brazil and Madagascar.[7] With their sultry sweet aromatic flavour and powerful essential oil compounds, cloves have been used for hundreds of years as a nutritional spice for food and a remedy for a variety of health concerns. Clove flowers and oil have been used extensively in traditional Indian and Chinese medicine for more than 2,000 years. Due to their capacity to preserve meals and cover the odour of improperly stored foods, cloves were particularly famous as a therapeutic flower in Europe in the seventh and eighth centuries after the arrival of the buds from Arabic traders in the fourth century A.D. [8]

### 1.2 Function of Clove:

*Eugenia Caryophyllus*, or cloves, were usually used to kill intestinal parasites thanks to their large anti-microbial properties against fungi and bacteria, thus supporting its traditional use as a treatment for diarrhea, intestinal worms and other digestive ailments. These anti-microbial properties also explain its use in deodorants and anti-fungal powders. [9] According to Artemis Herb Japanese researchers have discovered that like *Eugenia Caryophyllus* contains antioxidant properties which help avoid the cell spoil in the end causes malignant disease. [10] Eugenol, a component of many medicinal herbs, has both pro- and anti-cancer properties; nonetheless, it has been discovered to be a weak tumour promoter. [11][12]

### 1.3 Extraction of Clove:

Clove extraction was done by maceration method. Cloves are dried and cut into small pieces. Then, 250 grams of clove were soaked in 1.5 L of distilled water for 3x24 hours. [13][14] Afterwards, it was filtered and concentrated using an evaporator at 100°C for 8 hours until the extract was blackish brown in colour and had a strong characteristic aroma. Making Toothpaste Forming Gel Heat 25 ml of distilled water at 80°C for 15 minutes. Then, add 8.5 ml of propylene glycol, 2 ml of hydroxyapatite, 2 ml of nano silver, and 0.5 ml of clove extract. Then, the mixture was stirred until completely dissolved and slowly added 0.65 grams of CMC until a gel began to form. [15][16]

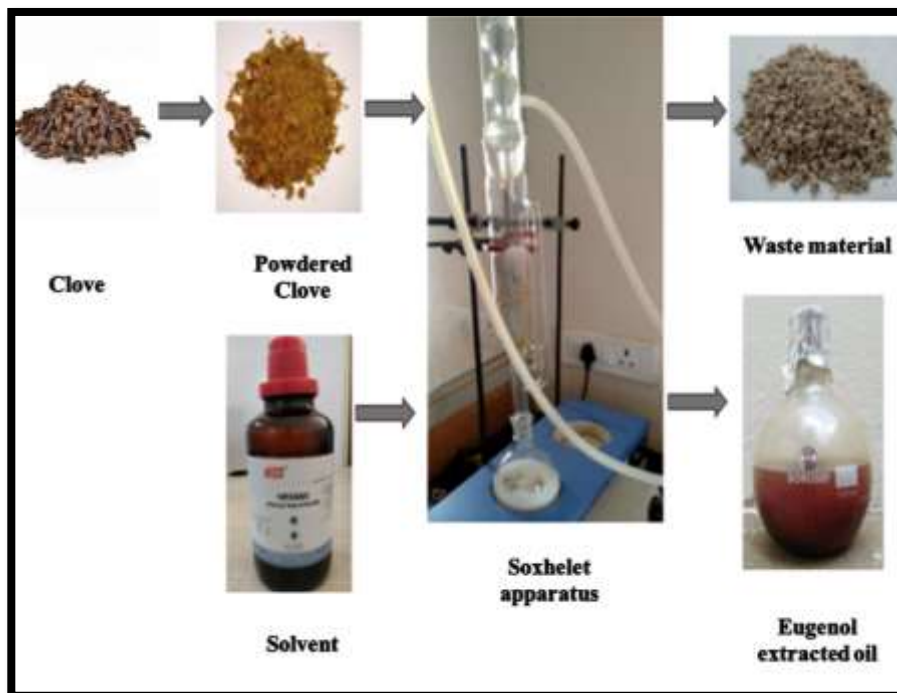


Figure 1.2: Extraction of Clove

### 1.4 Uses of clove in dentistry:-

#### a. Dental care:

The most prominent use of clove oil is in dental care. The germicidal properties of the oil make it very effective for relieve dental pain, tooth ache, sore gums and mouth ulcers. Clove oil contains the composite eugenol, which has been used in dentistry since numerous years. Clove oil gargles can assist to soothe the throat. The unique smell of clove oil helps to get rid of bad breath. Clove oil is therefore included in a variety of dental goods and treatments, such as mouthwashes and tooth pastes. As a temporary replacement for root canal therapy, dentists also combine clove oil with zinc oxide and create a white filling substance. [17]

#### b. Oral thrush:

Oral thrush, also called oral candidacies, is a yeast infectivity of the mouth. It happens when there's a build-up of the *Candida albicans* fungus in the coating of the mouth. Oral thrush may occur in adults or children. Clove oil, it's still in dentistry today as antiseptic and pain reliever. According to a 2005 in vivo and in vitro study on immunosuppressed rat, the main compound in clove oil (eugenol) was found to be as effective in treating oral thrush as the antifungal drug. Clove contain eugenol is the most powerful of these, with antiseptic properties that have been shown to kill the *Candida* yeast cells. Eugenol is also an immune system stimulant, which means it helps to increase the body's disease fighting powers.[18]

#### c. Treat Infections:-

Due to its antiseptic properties, clove oil is useful for wound, cuts, scabies, athlete's foot, fungal infections, bruises, prickly heat, scabies etc. It can also be used insect bites and stings. [19]

#### d. Stress:-

Clove oil is aphrodisiac in nature and hence serves as an outstanding stress reliever. It has a exciting effect on the mind and removes mental collapse and fatigue. When taken internally, in proper amounts, it refreshes the

mind. Clove oil also induces the sleeps and is helpful to insomnias patients. It is useful for treating mental problems such as loss of memory, depression and anxiety. [20]

e. Respiratory problems:-

Clove oil has a cooling and anti-inflammatory effect, and in this manner clears the nasal passage. This expectorant is useful in various respiratory disorders including coughs, colds, bronchitis, asthma, sinusitis, and tuberculosis. [21]

## 2. Materials & Method:

Zinc Oxide Eugenol Cement is a combination. A putty-form base agent composition in which 5.0 to 50.0% by weight of silicic acid having a mean particle size of 2 to 2000 millimicrons are contained in an eugenol containing base agent composition, and a putty-form setting agent composition in which 0.5 to 15.0% by weight of an inorganic filler material having a solubility of up to 0.2 g per 100 ml of water at 20 setting agent composition. [22]

Table 1.1: Materials used for different formulations

Ingredient name	F1	F2	F3
Zinc oxide	2.5 gm	2 gm	2.3 gm
starch	2.5 gm	2 gm	2.3 gm
White soft paraffin	5.0 gm	4 gm	1gm
clove	10gm	1gm	4 gm

Method: [23][24]

- Melt the white soft paraffin on water bath.
- Separately pass the zinc oxide and starch through sieve no.120. mix the required weight of powder in a warm mortar.
- Add small amount of melted base, with continuous triturating until smooth paste is obtained.
- Add the remaining part of the base and mix until cold and uniform paste is obtained.
- Transfer to a suitable container, label and dispense.
- In a motor-pestle, 10 gm of clove extract were triturated with zinc oxide 2.5gm of white soft paraffin.



Figure 1.3: Herbal toothpaste

## 3. Characterization

### (i) Physical Appearance:

The formulated toothpaste and marketed toothpaste were subjected to detect any change in appearance of toothpaste when kept for long period of time.

## (ii) pH:

pH of formulated herbal toothpaste was determined by using pH meter. 1g of toothpaste placed in 100ml of beaker. Allow the 10ml of distil water. Stir vigorously and make a mixture.

(iii) Moisture Content: Toothpaste (10 gm) weighted in a Porcelain dish and dried it in the oven at 105°C. It was cooled in a desiccator. The loss of weight is recorded as percentage moisture content and calculated by the given formula.

$$\% \text{ Moisture} = \frac{\text{Original sample weight} - \text{dry sample weight}}{\text{Original sample weight}}$$

## (iv) Spreadability:

In this method slip and drag characteristics of paste involve. Formulated paste (2g) placed on the ground slide under study. The formulated paste placed like sandwich between this slide and another glass slides for 5min to expel air and to provide a uniform film of the paste between slides. Excess of the paste was scrapped off from the edges. The top plate was then subjected to pull of 80g with the help of string attached to the hook and time (sec) required by the top slide to cover a distance of 7.5cm was noted. A short interval indicated better spread ability. Formula was used to calculate spread ability

$$S = M \times L / T$$

Where, S= Spreadability

M= Weight in the pan (tied to the upper slide)

L= Length moved by the glass slide

T=Time (sec) taken to separate the upper slide from the ground slide. [25][26]

## (v) Abrasiveness:

A rough quality in a substance that can be used to clean a surface or make it smooth. DA values for common toothpaste range from a rating of 0-70 which is considered low abrasive, 70-100 which is considered medium abrasive, 100-150 which is considered highly abrasive and 150-250 which is considered as harmful.

## (vi) Cleaning ability:

Toothpaste is used to promote oral hygiene: it is an abrasive that aids in removing dental plaque and food from the teeth, assists in suppressing halitosis, and delivers active ingredients (most commonly fluoride) to help prevent tooth decay (dental caries) and gum disease (gingivitis). This test is done in order to determine the **cleaning ability** of the dentifrice.

## 4. Results & Discussion

### (i) Physical Appearance:

Table 1.2: Physical appearance of various formulations

Physical appearance	F1	F2	F3	F4
<b>Colour</b>	Reddish brown	Reddish brown	Reddish brown	Yellowish brown
<b>Odour</b>	Strong spicy, aromatic odour, and pungent	Strong spicy, aromatic odour, and pungent	Strong spicy, aromatic odour, and pungent	Strong spicy, aromatic odour, and pungent
<b>Appearance</b>	Separated liquid	Separated liquid	Separated liquid	Separated liquid
<b>Feel of application</b>	Smooth	Smooth	Smooth	Rough



## (ii) pH:

The pH of toothpaste formulation were determined by using the digital PH meter. The pH value greater than 7 Indicates that the solution is basic while the neutral solution has a pH value of 7. Most of the toothpaste consists of bases in order to neutralize the mouth acid. Hence, the pH value of toothpaste was found 9.

## (iii) Moisture Content:

Table 1.3: Moisture Content of various formulations

S.No.	Formulations	Moisture Content (%)
1	F1	12.56
2	F2	12.96
3	F3	11.77
4	F4	14.56

## (iv) Spreadability:

The spreadability of toothpaste formulations was determined by placing one gram of toothpaste on a glass slide and then covering it with another slide of the same length the assembly. The top slide's time to traverse a distance of 6.5 cm was measured after the extra toothpaste was scraped off the sides and the top slide was pulled 50 g by a line tied to a hook.

## (v) Abrasiveness:

On a clean plastic microscope slide, a pea-sized amount of toothpaste was applied, and then a drop of distilled water was added. 30 quick strokes back and forth with a clean cotton swab were applied to the toothpaste sample. The slide was care-fully rinsed and dried with soft tissue. The slide was examined under a dissecting microscope illuminated from above. The number of scratches on the surface of the slide were determined and rated on a scale of 0 (no scratch) to 5 (high degree of scratches).

Table 1.4: Abrasiveness of various formulations

S.No.	Formulations	RDA
1	F1	25
2	F2	41
3	F3	29
4	F4	27

## (vi) Cleaning ability:

One egg-shell was used for each toothpaste tested. 200ml of water was heated to boiling in a beaker. 15ml and 20 drops of vinegar and red food colouring were added respectively. A hard-boiled egg was immersed in the food colouring solution for 5 minutes until it is stained with red colour. Using a permanent marker, a line was drawn along the length of the eggshell dividing it in half. A tooth-brush moistens with distilled water and the water shaken off was used to brush one side of the egg for 10 strokes (each stroke was a complete back and forth motion). The egg was inspected for any colour removal. The toothbrush was rinsed with water and the water shaken off, a pea-sized amount of formulated toothpaste was placed on the toothbrush and the brush was used to brush one side of the egg for 10 strokes. The egg was rinsed and inspected for colour removal.

**5. Conclusion:**

In the present work, it was decided to extract and formulate herbal toothpaste. The work revealed that the formulations found to be stable. The formulations were stable, had a pH that was nearly constant, seemed uniform and spreadable, and were free of sensitization and mouth problems. The extract of clove has antiseptic activity and anti-inflammatory activity, and also increases whitening of teeth, the clove oil increases freshness of the mouth as well as anesthetic helps to reduce pain and good properties. Hence all these properties are beneficial to normal human tooth and mouth it is safe and stable too.

## 6. References:

1. Tjandrawinata R, Widyarman AS, Lilianny D. Eugenia caryophyllus toothpaste reduces periodontal pathogens in saliva of Indonesian subjects. *EurAsian Journal of BioSciences*. 2020 Aug 1;14:3957-61.
2. Badawy MS, Riad OK, Taher FA, Zaki SA. Chitosan and chitosan-zinc oxide nanocomposite inhibit expression of LasI and RhlII genes and quorum sensing dependent virulence factors of *Pseudomonas aeruginosa*. *International journal of biological macromolecules*. 2020 Apr 15;149:1109-17.
3. Abou Neel EA, Bakhsh TA. An Eggshell-Based Toothpaste as a Cost-Effective Treatment of Dentin Hypersensitivity. *European Journal of Dentistry*. 2021 Oct;15(04):733-40.
4. Rajhi H, Bardi A, Dakhli A, Arthaoui S, Sacrafi N, Bousnina H, Abichou M. Valorization of olive by-products in new biobased toothpaste: health and sustainability advantages. *Biomass Conversion and Biorefinery*. 2021 Sep 3:1-0.
5. Rajhi H, Puyol D, Martinez MC, Diaz EE, Sanz JL (2015) Vacuum promotes metabolic shifts and increases biogenic hydrogen production in dark fermentation systems. *Front Environ Sci Eng* 10:513–521.
6. Schönfeld P, Kahlert S, Reiser G (2004) In brain mitochondria the branched-chain fatty acid phytanic acid impairs energy transduction and sensitizes for permeability transition. *Biochem J* 383:121–128.
7. Chandakavathe BN, Kulkarni RG, Dhadde SB. Formulation and Assessment of In Vitro Antimicrobial Activity of Herbal Toothpaste. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*. 2022 Nov 1:1-7. a molecular, biological, and epidemiological study Kumarasamy, Karthikeyan K et al. *The Lancet Infectious Diseases*, Volume 10, Issue 9, 597 – 602
8. Dr. Ramesh K. Goyal, Dr. Anita A. Mehta, Dr. Gaurang B. Shah, Derasari and Gandhi, s, *Elements Of Human Anatomy and Physiology And Health Education*, B.S. Shah Prakashan, Pg No.158
9. Kumar, Gn. (2017). Preparation, Evaluation and Comparison Of Herbal Toothpaste With Markedly Available Toothpastes. *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 12(6), PP.
10. SethiyaSaloni, Sadhana Shailendra; Preparation and Evaluation of herbal toothpaste; *Asian journal of pharmaceutical research and development*; vol4(1) Jan-Feb2016;1-5
11. Hamad AM, Atiyea QM. Study the effect of zinc oxide nanoparticles and dianthus caryophyllus L. extract on streptococcus mutans isolated from human dental caries in vitro. In *AIP Conference Proceedings 2022 Oct 25 (Vol. 2398, No. 1, p. 040046)*. AIP Publishing LLC.
12. Sreenivasan PK, Kakarla VV, Sharda S, Setty Y. The effects of a novel herbal toothpaste on salivary lactate dehydrogenase as a measure of cellular integrity. *Clinical oral investigations*. 2021 May;25(5):3021-30.
13. Tjandrawinata R, Widyarman AS, Lilianny D. Eugenia caryophyllus toothpaste reduces periodontal pathogens in saliva of Indonesian subjects. *EurAsian Journal of BioSciences*. 2020 Aug 1;14:3957-61.
14. Davies R, Scully C, Preston AJ. Dentifrices- an update. *Medicina Oral Patologia Oral. CirugiaBucal*. 2010;15(6):976– 82. doi:10.4317/medoral.15.e976.
15. X. Fatima Grace, Darsika C, Sowmya K.V, Azra Afker, S. Shanmuganathan. Preparation and evaluation of herbal dentifrice. *Int. Res. J. Pharm.* 2015; 6(8):509-511 <http://dx.doi.org/10.7897/2230-8407.068102>
16. Yoshimura M, Amakura Y, Yoshida T (2014) Polyphenolic compounds in clove and pimento and their antioxidative activities *Bioscience. BiotechnolBiochem* 75(11):2207–2212
17. Bownik A. Clove essential oil from *Eugenia caryophyllus* Induces Anesthesia, Alters Swimming Performance, Heart functioning and Decreases Survival Rate during Recovery of *Daphnia magna*. *Turk J Fish Aquat Sc.*
18. Sahu P, Sahu GK, Sharma H, Kaur CD. Formulation, characterization and ex vivo evaluation of epinephrine transdermal patches. *Research Journal of Pharmacy and Technology*. 2020;13(4):1684-92.

19. Nagwanshi P, Sahu L, Sahu P, Sahu A, Sharma H, Sahu G. Emphasis of Phytoconstituent in the treatment of cancer. *Research Journal of Pharmaceutical Dosage Forms and Technology*. 2020;12(3):169-77.
20. Sahu P, Nema RK. Bioenhancer: an agent for increasing bioavailability. *World J Pharm Res*. 2021 Apr 1;10(6):613-34.
21. Sahu P, Mishra S, Sahu GK, Sharma H, Kaur CD. Formulation and Characterization of Resorcinol Gel. *Research Journal of Pharmaceutical Dosage Forms and Technology*. 2019;11(3):159-63.
22. Sahu L, Nagwanshi P, Sahu P, Sahu A, Sahu G, Sharma H. Novel Approaches of Treatment of Cancer: Nanoparticle. *Research Journal of Pharmaceutical Dosage Forms and Technology*. 2020;12(2):115-24.
23. Ali S, Sahu A, Sahu P, Sharma H, Gulati M, Menon SA, Anik S, Sahu GK. A Global Public Health Emergency: COVID-19.
24. Sahu P, Mishra S, Sahu GK, Sharma H, Kaur CD. Formulation and Characterization of Resorcinol Peel. *Research Journal of Pharmacy and Technology*. 2019;12(11):5437-43.
25. Sahu P, Bhimte P, Sharma H, kumar Sahu G. A Modern Era Prospective of Novel Drug Delivery System.
26. Sahu M, Choubey R, Sahu P, Mishra A. A comparative molecular docking study of *Syzygium cumini* to understand the binding pattern with four different proteins Used for anti-diabetic activity.