



RESEARCH ON: FORMULATION AND EVALUATION OF TOOTHPASTE

*Mitali Gajbhiye, Achal Ghengare, Vaishnavi Lohabade, Divya Chafale and Divyani Khanke

Department of Pharmaceutics, Siddhivinayak College of Pharmacy, Warora, Chandrapur, Maharashtra.



*Corresponding Author: Mitali Gajbhiye

Department of Pharmaceutics, Siddhivinayak College of Pharmacy, Warora, Chandrapur, Maharashtra.

Article Received on 26/03/2024

Article Revised on 17/04/2025

Article Accepted on 07/05/2025

ABSTRACT

Toothpastes are complex mixtures of abrasives and surfactants; anticaries agents, such as fluoride; tartar control ingredients; pH buffers; humectants (to prevent dry-out and increase the pleasant mouth feel); and binders, to provide consistency and shape. Binders keep the solid phase properly suspended in the liquid phase to prevent separation of the liquid phase out of the toothpaste. The dental paste preparations of toothpaste designed using different bases for treatment of gingivitis, periodontitis and dental plaque. During our Physicochemical evaluation studies all the formulations were found to have PH, good tube extrudability, good Spread ability and viscosity characteristics.

KEYWORDS: Formulation, Ingredient, Toothpastes, Mouth-Washes, Abrasives.

INTRODUCTION

Toothpastes have been used since the ancient past^[1] and are one of main irreplaceable components of oral health care. The design of toothpaste formulations began in China and India, as 300-500 BC. During that period, squashed bone, pulverized egg and clam shells were utilized as abrasives as a part of tooth cleaning. Modern toothpaste formulations were developed in the 19th century. Later on, chalk and soap were incorporated to those formulations. After 1945, several formulation advancements of different detergents had begun; sodium lauryl sulfate had been used as emulsifying agent. In recent years, the focus has shifted towards the release of active ingredients during Formulation. Toothpaste is a dentifrice used to clean, maintain and improve the health of teeth. halitosis, and releases active ingredients such as fluoride to aid in preventing tooth and gum disease toothpastes are complex mixtures of abrasives and surfactants; anticaries agents, such as fluoride; tartar control ingredients; pH buffers; humectants (to prevent dry-out and increase the pleasant mouth feel); and binders, to provide consistency and shape. Binders keep the solid phase properly suspended in the liquid phase to prevent separation of the liquid phase out of the toothpaste. They also provide body to the dentifrice, especially after extrusion from the tube onto the toothbrush. It is the responsibility of the oral care professional to understand the ingredients in toothpastes and direct patients to different products based upon their individual needs A paste or gel dentifrice which is used to clean and maintain aesthetics and health of teeth with the help of a toothbrush is called toothpaste. It is said to

be dentifrice that is in the form of smooth semisolid homogeneous mass containing surfactant, binders, polishing agent, humectants, abrasives, and other appropriate materials to maintain oral health. Proper oral hygiene should be maintained otherwise it will cause several dental problems like cavities, tooth sensitivity, calculus, and periodontal disease. toothpaste is referred to as an oral hygienic product to maintain the health of teeth. based toothpaste has been used since many years ago in ancient life and is one of the main important components of oral health care. In current scenario in oral dental care with use of toothpaste containing natural ingredients are more acceptable in public belief than chemical based synthetic formulations due to their safety and efficacy in reducing dental caries, and preventing other dental issues to which this generation is prone to. Immediately after the independence, several formulation advancements of different detergents had begun, sodium lauryl sulfate had been used as an emulsifying agent. Toothpaste is a dentifrice used to clean, maintain and improve the health of teeth. Toothpaste is mainly used to promote oral cleanliness and also acts as an abrasive that helps to prevent the dental plaque and food particles from the teeth, aids in the removing and/or veiling of halitosis, and releases active ingredients such as fluoride to aid in preventing tooth and gum disease (eg. Gingivitis).The majority of the cleaning is performed bythe mechanical involvement of the toothbrush with the help of excipients used in toothpaste. To promote the attractiveness and to maintain the health of teeth the formulation is used called as toothpaste 1. For cleaning the teeth, toothpaste are widely used preparations 2. This primary function of

cleaning is carried out with the help of a toothbrush. The objective behind the use of tooth paste is its ability to deliver preventive and therapeutically active agents such as fluoride, metal salts and pyrophosphate. These agents may be useful for calcium inhibition also reduce the growth of plaque and to treat dentine hypersensitivity along with dental hygiene. Along with refreshing breath, removal of food particles, reduction of superficial plaque or stain, polishing of tooth surface is the function of toothpaste or dentifrices. Some therapeutic and cosmetic functions may be desired such as whitening, bleaching, desensitizing, inhibition of plaque formation and protection against periodontal problems. Active pharmaceutical ingredients, abrasives, humectants, detergents, binders, sweeteners, preservatives and antioxidants, and Flavors are the most commonly used ingredients of toothpaste 1, 2. There is a number of materials, and their combinations were used in the formulation of toothpaste but they might damage teeth and gums. Hence, nowadays there is a need for safe, effective and wellformulated dentifrices 3. To achieve this, present work deals with formulation and evaluation of toothpaste containing aloe and sodium chloride the rationale behind the combination is to fight against the bacteria that cause problems regarding to teeth like gum, dental cavity and gingivitis. Aloe vera is the oldest medicinal plant ever known and the most applied medicinal plant worldwide 4. The Aloe vera plant shows antimicrobial activity due to the presence of plant's natural anthraquinones: aloe emodin, aloetic acid, aloin, anthracene, anthranol, barbaloin, chrysophanic acid, ethereal oil, an ester of cinnamonic acid, isobarbaloin, and resistannol 5. The paste containing a high concentration of Sodium chloride content prevent the formation of the coat because of *Leptotrichae* is the coating around the teeth which absorbs colors. It is very difficult to remove such coating by a dentist might cause harm to enamel. To prevent the formation of such layers and their spreading sodium chloride may be used in high concentration 6. The most popular preventive method for oral health care is toothpastes. Many dentifrices sold commercially make claims about having antibacterial characteristics, although little study has been done to verify these claims. As a result, this study was carried out to assess the effectiveness of various toothpaste formulations in lowering the oral microbial burden. The formulas of the chosen tooth pastes were successful in reducing the microbial load, which helped to maintain good oral hygiene. The efficiency of the various chemicals in the toothpastes used, however, is less important for maintaining excellent oral health than using the proper oral hygiene practises and brushing technique. One of the most prevalent oral conditions with a significant incidence worldwide is chronic gingivitis. The primary cause and initiating factor for the onset of gingivitis is dental plaque. However, due to the limitations of mechanical approaches, it is also thought to be a suitable supplement to the control of mechanical plaque to add some safe and effective medications to prevent gingivitis to toothpaste. According to studies,

toothpaste additives like triclosan and chlorhexidine directly prevent plaque from forming on teeth. The major purposes of semisolid toothpaste formulations are oral cavity cleaning and oral hygiene maintenance. Today, toothpaste is seen as a basic human need because cleaning the mouth before bedtime prepares one for the day. Many commercially available toothpaste formulations are made with synthetic excipients, however some formulations are made with extracts. Reduced oral bacterial flora and fluoride delivery are toothpaste's primary goals. This is because fluoride, which is naturally present in many commonplace items including food and water, has been shown to protect teeth against bacterial attack. To promote dental health, toothpaste that effectively decreases oral bacterial flora should be used. Typically, triclosan is found in gum. Because of its antibacterial qualities, it is a component used to prevent gum disease. It is also known that sodium fluoride, the active component, has antimicrobial effects. Natural toothpastes are ones that don't contain fluoride or triclosan. They typically include natural compounds like lemon, eucalyptus, rosemary, chamomile, sage, and myrrh extracts as well as particular mineral salts like sodium fluoride. The major purposes of semisolid toothpaste formulations are oral cavity cleaning and oral hygiene maintenance. Today, toothpaste is seen as a basic human need because cleaning the mouth before bedtime prepares one for the day. Many commercially available toothpaste formulations are made with synthetic excipients, however some formulations are made with extracts. Reduced oral bacterial flora and fluoride delivery are toothpaste's primary goals. This is because fluoride, which is naturally present in many commonplace items including food and water, has been shown to protect teeth against bacterial attack. To promote dental health, toothpaste that effectively decreases oral bacterial flora should be used. Typically, triclosan is found in gum. Because of its antibacterial qualities, it is a component used to prevent gum disease. It is also known that sodium fluoride, the active component, has antimicrobial effects. Natural toothpastes are ones that don't contain fluoride or triclosan. They typically include natural compounds like lemon, eucalyptus, rosemary, chamomile, sage, and myrrh extracts as well as particular mineral salts like sodium fluoride and sodium chloride. The most effective way of preventing the development of dental disease is in controlling the production of dental plaque. Plaque is a soft thin layer which deposits on teeth gums and all appliances fitted in the mouth. It is formed by microbial action. Dietary sugars, in particular sucrose, contribute to the formation of plaque and their presence increases the rate of formation and thickness of plaque. The removal of plaque from the teeth and related areas is essential for the maintenance of a healthy mouth (1). In this paper we have presented the main components of toothpastes and mouthwashes. For the active ingredients, their supposed effect as therapeutic agents is also explained. A toothpaste is defined as a semi-solid material for removing naturally occurring deposits from teeth and is supposed to be used simultaneous with a

toothbrush. A mouthwash is defined as a non-sterile aqueous solution used mostly for its deodorant, refreshing or antiseptic effect. Mouthwashes or rinses are designed to reduce oral bacteria, remove food particles, temporarily reduce bad breath and provide a Mouthwashes (mouthrinses) are generally classified as either cosmetic or therapeutic or a combination of the two. Cosmetic rinses are commercial products that remove oral debris before or after brushing, temporarily suppress bad breath, diminish bacteria in the mouth and refresh the mouth with a pleasant taste. Therapeutic rinses often have the benefits of their cosmetic counterparts, but also contain an added active ingredient, (for example fluoride or chlorhexidine), that help protect against some oral diseases. The amount of the different ingredients in mouthwashes varies from product to product. Some practically have the same composition as toothpastes, although they do not contain abrasives. Distinct from toothpastes most mouth-washes contain alcohol, as a preservative and a semi-active ingredient. The amount of alcohol is usually ranging from 18 - 26 %. Toothpaste is a paste or gel to be used with a toothbrush to maintain and improve oral health and aesthetics. Since their introduction several thousand years ago, toothpaste formulations have evolved considerably - from suspensions of crushed egg shells or ashes to complex formulations with often more than 20 ingredients. Among these can be compounds to combat dental caries, gum disease, malodor, calculus, erosion and dentin hypersensitivity. Furthermore, toothpastes contain abrasives to clean and whiten teeth, flavors for the purpose of breath freshening and dyes for better visual appeal. Effective toothpastes are those that are formulated for maximum bioavailability of their actives. This, however, can be challenging as compromises will have to be made when several different actives are.

AIM

Formulation And Evaluation Of Toothpaste.

OBJECTIVES

1. To know the customer satisfaction level about the toothpaste
2. To identify the various factor influencing customer in purchase of the toothpaste.
3. To identify the various factor influencing customer in purchase of the toothpaste.
4. To study and examine the differential effects price promotion on consumer based Brand Equity.
5. To examine how the product attributes influence the customer to buy the toothpaste,
6. To understand review and define the attributes for "Brand success.

MATERIAL AND METHOD

- Calcium Carbonate
a dietary supplement used when the amount of calcium taken in the diet is not enough. Calcium is needed by the body for healthy bones, muscles, nervous system, and heart. Calcium carbonate also is used as an antacid to

relieve heartburn, acid indigestion, and upset stomach.

- Glycerin

Is a type of carbohydrate known as a sugar alcohol or a polyol. This odorless liquid has a sweet taste and a syrupy consistency. While glycerin occurs naturally in plants through the fermentation of sugars, most of the glycerin nowadays is produced from the hydrolysis of fats and oils.

- Tragacanth

Is a natural gum obtained from the dried sap of several species of Middle Eastern legumes of the genus *Astragalus*.

- Saccharin

Is a non-nutritive or artificial sweetener. It's made in a laboratory by oxidizing the chemicals *o*-toluene sulfonamide or phthalic anhydride. It looks like white, crystalline powder. Saccharin is commonly used as a sugar substitute because it doesn't contain calories or carbs.

- sodium lauryl sulfate (SLS).

This common ingredient creates the foam when you brush, but can also irritate sensitive teeth and gum. Sodium lauryl sulfate, an accepted contraction of sodium lauryl ether sulfate, also called sodium alkyl ether sulfate, is an anionic detergent and surfactant found in many personal care products and for industrial uses. SLES is an inexpensive and very effective foaming agent.

- Dicalcium Phosphate

Is the calcium phosphate with the formula CaHPO_4 and its dihydrate. The "di" prefix in the common name arises because the formation of the HPO_4^{2-} anion involves the removal of two protons from phosphoric acid, H_3PO_4 . It is also known as dibasic calcium phosphate or calcium monohydrogen phosphate.

- Purified Water

Refers to water that has undergone a process of purification to remove contaminants, impurities, and undesirable substances. The purification process eliminates substances such as chemicals, pollutants, microbes, and minerals, resulting in water that is clean, clear, and safe for consumption.

Procedure for preparation of toothpaste

1. Take half the quantity of water, add tragacanth powder & heat it in a water bath to get a gel.
2. To the remaining quantity of water, add glycerine, sodium lauryl sulphate, preservative & mix it thoroughly to get a clear solution.
3. Weigh the required quantity of saccharin and calcium carbonate solution & mix it with the help of mortar and pestle.
4. To this powder, add gum tragacanth & mix well.
5. Add glycerine, preservative & sodium lauryl mixture

- to it and triturate uniformly to get a paste.
6. Finally add flavouring agent & triturate well. □
Transfer to a narrow mouthed plastic tube, seal & label.

Evaluation

- a. Colour: Colour of the prepared toothpaste was evaluated for its colour. The colour was checked visually.
- b. Odour: Odour was found by smelling the product.
- c. Taste: Taste was checked manually by tasting the product.

Physical characterization test

- a. Determination of pH: Take 1 gm of the tooth paste in a 150 ml beaker and add 10 ml of freshly boiled and cooled water (at 27°C). Stir well to make a thorough suspension. Determined the pH of the suspension within 5 minutes, using digital pH meter. The results were mentioned.
- b. Foamability: The foam ability of the product was evaluated by taking small amount of preparation with water in measuring cylinder initial volume was noted and then shaken for 10 times. Final volume of foam was noted.

c. Study of Rheological properties

i. Spreadability: The Spreadability is term express to denote the extent of area to which the paste readily spreads on application area. One of the criteria for a paste to meet ideal quality is that it should posses good spreadability. About 1 gm of medicated dental paste was weighed and kept at the center of the glass plate (10 x10 cm) and, another glass plate was placed over it carefully. 1kg weight was placed at the center of the plate (avoid sliding of the plate). The diameter of the paste in cms, after 15 min. was measured The Spreadability (S) can be calculated using the formula $S=m.l/t$ Where, S– Spreadability. m-Weight tied to upper glass slide. l- Length moved glass slide. t-Time taken. The formulation under study was filled in a clean, lacquered aluminum collapsible one-ounce tube with a nasal tip of 5mm opening and applies the pressure on tube by the help of finger. Tube extrudability was then determined by measuring the amount of pastextruded through the tip when a pressure was applied on tube paste.

ii. Viscosity: Paste viscosity measurements were evaluated using a Brookfield digital viscometer (LV DV–II Ultras programmable Remoter, USA) using spindle no.3 by applying increasing values of the shear rate, in order to reveal possible flow behaviour of the pastes. All viscosities measurements were performed at controlled temperature of 30c.

RESULTS AND DISCUSSION

1. Colour : Pink
2. Odour Characteristic
3. Taste : Sweet
4. Stability : Stable

5. Spreadability Easily spread
6. Abrasiveness : Good abrasive
7. Foamability : Good,

Physical evaluation of Formulation:

1. pH 8.7
2. Spredability (cm) 7.7cm
3. Viscosity (CPS) 39751.6cps
4. Tube Excludability :Good

CONCLUSION

Following conclusion can be drawn from the results obtained in the present work of investigation. The dental paste preparations of herbal toothpaste designed using different bases for treatment of gingivitis, periodontitis and dental plaque. During our Physicochemical evaluation studies all the formulations were found to have PH, good tube extrudability, good Spreadability and viscosity characteristics.

REFERENCES

1. Nagehan Yilmaz, et al. (2021): Comparison of t abrasive effects of children's toothpaste on glass ionomer cement.
2. Marcin olek, et al. (2021): Advantages of using toothpaste containing propolis and plant oils for gingivitis prevention and oral cavity hygiene in cleft lip/palate patients.
3. Labiba El-Khordagui, Lamia A. Heikal, et al: 2021: Application of biosurfactants in the production of personal care products, and household detergents and industrial and institutional cleaners.
4. Jennifer Archibald DDS Dec 7 2020 Bad breath (Halitosis) written by Healthline editorialteam.
5. Timothy J Lafolla. Effectiveness of herbal oral care products in reducing dental plaque and gingivitis-A systematic review and meta-analysis, 2020.
6. Yesodha S.; A study on consumer brand preference of toothpaste in Chennai city; Mukta Shabd Journal, 2020; 9(5).
7. Dr. Uma S., Arun Yesudhas A.; A survey on the various factors that influence a customer's choice of toothpaste in mogappair population; IJCR, 2019; 11(3).
8. Mandan SS, Laddha UD and Surana SJ. Experimental Microbiology (Practical). Career publication, Nashik, 2017; 1st Ed. pp. 62-75.
9. avies R, Scully C and Preston AJ. Dentifrices- an update. Medicina Oral Patologia Oral Cirurgia Bucal, 2010; 15: 976-982.
10. Ersoy M, Tanalp J, Ozel E, Cengizlier R and Soyman M. The allergy of toothpaste: a case report. Allergol Immunopathol, 2008; 36: 368-370.
11. Jardim J, Alves L, and Maltz. M. The history and global market of oral home-care products. Brazilian Oral Research, 2009; 23: 17-22.
12. Mithal BM and Saha RN. A handbook of cosmetics. Vallabh Prakashan, 2000; 1st Ed. pp. 204- 212.
13. Kokate CK, Purohit AP and Gokhale SB. A Textbook of Pharmacognosy. Nirali Prakashan,

2002; 13th Ed: pp. 9.9-19.4.

14. Nema RK, Rathore KS and Dubey BK. A Textbook of Cosmetics. CBS Publisher and distributor, 2009; 1st Ed: pp.