

DENTAL PRODUCTS

Introduction

- ❖ The teeth are accessory digestive organs. People use their teeth to bite and chew food, the first step in the digestion of food. While we chew food, the tongue pushes the food to the teeth and saliva helps digestion and wets the food.
- ❖ A number of inorganic compounds are used in maintaining the oral and dental hygiene.
- ❖ Dental products include
 1. **Anticaries agents** - fluoride salts
 2. **Dentifrices or cleaning agents**- tooth powders, tooth pastes, liquid dentifrices
 3. **Polishing agents**- Mouth washes and rinses
 4. **Desensitizing agents** -Toothache drops, denture adhesives and denture cleaners

Parts of the Teeth

A typical tooth has three major external regions: the crown, root, and neck.

1 Enamel: Hard calcified (consists primarily of calcium phosphate and calcium carbonate) tissue covering dentin of the crown of tooth.

2 Crown: The crown is the visible portion of tooth above the level of the gums.

3 Gingiva (gums): Soft tissues overlying the crowns of unerupted teeth and encircling the necks of those that have erupted.

4 Pulp Chamber: The space occupied by the pulp.

5 Neck: The area where the crown joins the root.

6 Dentin: That part of the tooth that is beneath enamel and cementum.

7 Alveolar Bone (jawbone): The part of the jaw that surround the roots of the teeth.

8 Root Canal: The portion of the pulp cavity inside the root of a tooth; the chamber within the root of the tooth that contains the pulp.

9 Root: Embedded in the socket are one to three roots.

10 Cementum:Hard connective tissue covering the tooth root, giving attachment to the periodontal ligament.

11 Periodontal Ligament: A system of collagenous connective tissue fibers that connect the root of a tooth to its alveolus.

Anticaries Agents

- ❖ Dental caries (i.e. cavities), or tooth decay, involves a gradual demineralization (softening) of the enamel and dentin.

- ❖ If it is not treated then microorganisms bacterial flora may invade the pulp, causing inflammation and infection, with subsequent death of the pulp and root's apex, requiring root canal therapy.
- ❖ Dental caries are formed by the growth and implantation of cariogenic microorganisms. Bacteria (streptococcus mutans and lactobacillaceae) produce acids, mostly lactic acid that demineralize the enamel.
- ❖ The formation of bacterial plaque also helps the decay process by forming pockets on the tooth surface in which the food particles can stick and be decayed by the bacteria.
- ❖ If plaque is not removed it calcifies into calculus when calcium salt precipitates from the saliva. Brushing the teeth helps in removing the material from the tooth surface before it hardens into calculus.
- ❖ Dental caries can be prevented and oral and dental hygiene can be maintained with the help of dentifrices.
- ❖ The most accepted approach to prevent caries includes flossing and brushing accompanied by administration of fluoride either internally or topically to the teeth. Examples, Sodium fluoride, Stannous fluoride, Sodium mono fluoro phosphate.

Role of fluoride in the treatment of dental caries

- ❖ The fluoride ion is bond with the enamel and make it tough against dental caries, topical fluorides such as those present in tooth pastes, mouth washes and gels.
- ❖ Fluoride ion is a trace material which occur in our body, obtained from food and water.
- ❖ Addition of fluoride to the water, ie) fluoridation is able to help in reducing and preventing dental caries. But those who receives slow continued ingestion of fluoride may suffer from mottling of teeth increased strength of bones, gastric disturbances, muscular weakness, convulsions and even heart failure.
- ❖ Fluoride in solution or in rapidly soluble salts when administered internally is readily absorbed from the gastrointestinal tract, partially deposited in the bone or developing teeth and the remainder gets excreted by the kidneys.
- ❖ Fluoride as it replaces the hydroxyl ion in hydroxyapatite with the fluoride ion to form fluorapatite in the outer surface of the enamel.
- ❖ Fluorapatite hardens the enamel and makes it more acid resistant. Fluorapatite has also shown antibacterial activity.
- ❖ Fluoride is most beneficial up to an age of 12 or 13 because unerupted permanent teeth are mineralizing during that time.
- ❖ A small quantity of fluoride (1ppm) is necessary to prevent caries. If more quantity (2-3ppm) is ingested it is carried to bones and teeth and gives rise to mottled enamel known as dental fluorosis.

- ❖ Fluoride can also be administered orally as sodium fluoride tablets or drops added in water or fruit juice.
- ❖ It is not always feasible to administer fluoride internally and in post-adolescent individuals, it is not beneficial. In such cases, fluoride can be administered topically. A 2% aqueous solution of sodium fluoride is widely used topically. A freshly prepared 8% solution of stannous fluoride is also extensively used for topical application of fluoride.

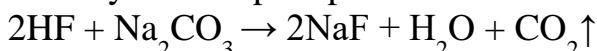
- ❖ Besides fluorides, Inorganic phosphate salts can also be useful in the prevention of dental caries. It has been shown that soluble salts of phosphates (e.g., calcium sucrose phosphate, sodium dihydrogen phosphate, sodium monohydrogen phosphate etc.)

1. Sodium Fluoride: NaF Mol. Wt. 41.99

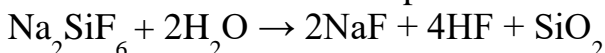
- ❖ It contains not less than 98.5 percent and not more than 100.5 percent of NaF, calculated with reference to the dried substance.

Preparation:

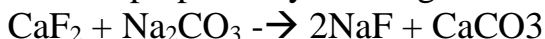
1. It is prepared by reacting hydrofluoric acid with sodium carbonate. Sodium fluoride being not very soluble precipitates out.



The precipitate is contaminated with fluorosilicate and the acid salt. It is made alkaline to phenolphthalein with sodium carbonate and then heated to neutralize the acid salt and decompose the fluorosilicate.

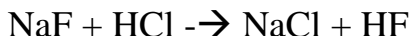


2. It can also be prepared by reacting calcium fluoride with sodium carbonate.

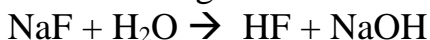


Properties

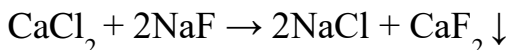
- ❖ It occurs either as a white powder or as colourless crystal.
- ❖ It is soluble(1 in 25) in water but is practically insoluble in alcohol.
- ❖ When a mineral acid is added, hydrofluoric acid is produced. This is weak acid and is poisonous.



- ❖ Since sodium fluoride is the salt of a weak acid and a strong base, it hydrolyzes in aqueous solution to give an alkaline reaction.



- ❖ Calcium chloride gives a white gelatinous precipitate of CaF_2 with fluoride ions. The precipitate dissolves in ferric chloride solution.



- ❖ It forms stable complexes with ferric compounds.



This reaction was the basis of an assay method for sodium fluoride. In this method a neutralized solution of sodium fluoride in a strong alkaline solution was titrated with a freshly prepared and standardized ferric chloride solution. Potassium thiocyanate was used as the indicator. End point is the appearance of a red colour (ferric thiocyanate), Sodium fluoride gives a yellow colour (due to the formation of a complex with a zirconyl-alizarin red lake).

Test for purity: It has to be tested for acidity or alkalinity; fluorosilicate; clarity and colour of solution; chloride; sulphate and loss on drying.

Assay:

1. It is assayed by non-aqueous titration method as per IP.
 - ❖ Weigh accurately about 80 mg and add a mixture of 5 ml of acetic anhydride and 20 ml of anhydrous glacial acetic acid to it. Heat to dissolve, cool, add 20 ml of dioxan and titrate with 0.1M perchloric acid using crystal violet solution as indicator until a green colour is produced. Carry out a blank determination and make any necessary correction.
 - ❖ Each ml of 0.1M perchloric acid is equivalent to 0.004199 of NaF
2. It is also assayed by complexometric titration method using disodium edentate.

Uses: It is used as preventive for dental caries because of its fluoride ion content.

Usual dose: 2.2 mg (equivalent to 1 mg of fluoride ion)

Application: 1.5-3.0 ppm (equivalent to 0.7-1.3 ppm of fluoride ion) in drinking water; topically, as 2% solution to the teeth.

Formulations: Sodium fluoride is administered as solution, tablet, oral gel for systemic use or as mouth wash for local use.

Storage. Store protected from moisture.

Dentifrices or Cleaning agents

- ❖ Dentifrice is a material which is used for cleaning tooth surfaces and adjacent gums with the help of tooth brush.
- ❖ Dentifrices are applied as powders or pastes which contains trace materials such as fluoride, antiseptics, deodorants etc.
- ❖ Flavours and colours are usually added to dentifrices for improving their acceptance.
- ❖ A good cleaning agent must remove stains from teeth and to achieve this suitable abrasiveness is essential.
- ❖ Examples, Calcium carbonate, Dibasic and tribasic calcium phosphate, Sodium meta phosphate, Strontium chloride, pumice powder (Complex silicates of aluminium, potassium and sodium).

Calcium Carbonate, CaCO_3

- ❖ It is also called as precipitated chalk.
- ❖ It is a fine powder used in dentifrices both in powder and paste.
- ❖ It gives both abrasive and antacid effects in mouth.

Preparation

1. In nature, it is found in chalk, marble, lime stone, aragonite, calcite, pearls and shells.

2. On commercial scale, it is prepared by mixing the boiling solutions of calcium chloride and sodium carbonate and allowing the precipitate to settle down. The ppt is washed with boiling water to remove chlorides and dried.



Properties

1. It is a white fine, microcrystalline powder.
2. It is colourless and tasteless.
3. It is insoluble in water and alcohol.
4. It neutralizes acid with effervescence.



Test for purity

It is tested for Al, Fe, Phosphate, matter insoluble HCl, As, Heavy metals, Cl, SO₄, Ba, soluble alkali and loss on drying.

Assay

It is assayed by complexometric method.

Medicinal use

It is used as dentifrices, antacid along with magnesium salt, because it produce constipation for continuous used as antacid.

Dose : 1-4 g, six times per day

Storage : stored in tightly closed containers.

Polishing Agents

- ❖ Dentifrices contain agents for cleaning tooth surfaces and providing polishing effect on the cleaned teeth.
- ❖ They are responsible for physically removing plaque and debris.
- ❖ The overall effect provides whiteness to the teeth.
- ❖ Many dentifrices have desensitizing agent along with polishing agents.
- ❖ Examples include dicalcium phosphate, sodium metaphosphate, calcium pyrophosphate, calcium carbonate and calcium monohydrogen phosphate.

Desensitizing Agents

- ❖ Desensitizing agents reduce the pain in sensitive teeth caused by cold, heat or touch.
- ❖ These products should be non-abrasive and should not be used on a regular basis unless directed by a dentist.
- ❖ They act probably like local anaesthetic.
- ❖ Examples include strontium chloride and zinc chloride.

Oral antiseptics and Astringent

- ❖ Some inorganic compounds are used as antiseptics in oral cavity.
- ❖ For oral hygiene some products having inorganic chemicals may be used for antiseptic (To destroy micro organism) and/or astringent action (Precipitate protein)

- ❖ Examples- Hydrogen peroxide, Sodium perborate, Magnesium peroxide.

Mouth Washes

- ❖ Mouth washes having zinc sulphate (for antiseptic and astringent action) or zinc chloride (for deodorant and Desensitizing action) or potassium permanganate (for antiinfective and astringent action) or sodium bicarbonate (for its antacid property) or sodium chloride (for irrigation) are generally used in dental for various reasons.
- ❖ Ammoniacal silver nitrate solution is also used for its astringent action and also decrease hyper sensitivity of teeth and gums.

Cements and fillers

- ❖ Dental cements are used to temporarily cover protect areas that have undergone dental surgery.
- ❖ The cementing material is applied as a paste, which get hardened and forming protective layer. After operation, the cement can be removed.
- ❖ The cement is also medicated with eugenol which is antiseptic and local anaesthetic.
- ❖ The cement of suitable consistency used as temporary filler for cavities.
- ❖ Some metals like Gold and Silver are used as permanent filling materials.

Zinc-Eugenol Cement

Preparation: Zinc-Eugenol cement consists of two parts and is prepared as follows

Part A. The Powder:

Zinc Acetate 0.5 g
Zinc Stearate 1 g
Zinc Oxide 70 g
Rosin 27.5 g

Rosin is powdered and mixed with about an equal weight of zinc oxide. The mixture is sifted through a sieve of not less than 100–mesh. The material retained on the sieve is regrinded with additional zinc oxide, and sifted again. The process of regrinding and sifting is repeated until all of the material passes readily through the sieve and the two mixtures are then mixed with the remainder of the zinc oxide.

Part B. The Liquid:

Eugenol 85 ml
Cottonseed Oil 15 ml

The liquids are mixed together in the proportion specified.

Zinc-Eugenol cement is prepared by mixing 10 parts of the powder with 1 part of the liquid to a thick paste immediately before use. For obtaining any desired consistency the amount of the liquid may be varied.

Uses:

It is a temporary cement with a zinc oxide eugenol base for crown and bridge procedures.

It can be used in dentistry as a filling or cement material.

It is used in temporary restorations, in managing dental caries as a temporary filling .

It is also used as an impression material during construction of complete dentures.

Zinc-Eugenol cement has anaesthetic and antimicrobial effect due to the eugenol content and is used in painful conditions of dental pulp.