Subject
Pharmaceutical Inorganic Chemistry

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Dental Products

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Dental Products

Dental products:

The agents that can be used for the treatment of dental and oral disorders are known as dental products.

Classification:

They can be classified as:

1) Anticaries agents:

•Microorganisms act on carbohydrate in mouth and produce acid. This acid carry out decalcification of teeth. This cause dental caries or tooth decay. The agents which are used to prevent or treat dental caries or tooth decay are known as anticaries agents.

•Ex. Sodium fluoride, sodium monofluorophosphate, stannous fluoride.

2) Dentrifrices:

•The agents that can be used for cleaning of teeth and adjacent gums are known as dentrifrices.

•They can be applied with use of finger or tooth brush.
•Ex. Calcium carbonate, Dibasic calcium phosphate, calcium phosphate, sodium metaphosphate, strontium chloride, pumice.

3) Desensitizing agents:

Teeth are sensitive to heat and cold. In case of tooth decay, they become more sensitive.

The agents which reduce sensitivity of teeth towards heat and cold are known as desensitizing agents.

Ex. strontium chloride, zinc chloride.

4) Oral antiseptics and astringents:

Few inorganic chemicals can be used for oral hygiene are known as oral antiseptics and astringents.

Ex. Hydrogen peroxide, Magnesium peroxide, sodium perborate.

5) Mouth wash:

They are employed for various purpose like mild antiseptic, astringent, deodorant, desensitizing action.

Ex. Zinc sulphate, zinc chloride, potassium permenganate etc.

6) Cements and fillers:

They are temporarily used to cover and protect areas on which dental surgery has been performed.

Ex. Zinc oxide.

Sodium fluoride

Mol. Formula: NaF **Mol. Wt.:** 41.99 gm/mol

Contains not less than 98% of NaF.

Preparation:

1). Prepared by treatment between hydrofluoric acid and sodium carbonate.

$$2\,HF + Na_2CO_3 \longrightarrow 2\,NaF + H_2O + CO_2$$

2) By treatment between calcium fluoride and sodium carbonate.

$$CaF_2 + Na_2CO_3 \longrightarrow 2\ NaF + CaCO_3$$

Properties:

- Colorless, odorless crystals.
- Soluble in water, insoluble in alcohol.
- On acidification, it produces hydrofluoric acid that is poisonous.

Uses:

- Retards or prevents dental caries.

Application:

- 2% solution of 1.5 to 3 ppm NaF in drinking water can be used topically for teeth.

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Calcium carbonate

Synonym: Precipitated chalk

Mol. Formula: $CaCO_3$ **Mol. Wt.:** 100 gm/mol

It is having not less than 98% and not more than 100% of $CaCO_3$.

Preparation:

1) Commercially, it is prepared by mixing hot solution of calcium chloride with sodium carbonate.

$$CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + 2\,NaCl$$

Properties:

- Fine, white and micro-crystalline powder.
- Odorless

- Tasteless
- Insoluble in water and alcohol.
- It neutralizes acid with effervescence.

Uses:

Used externally as dentifrice.

Internally as an antacid.

It cause constipation when taken internally so taken along with magnesium salts.

Dose:

1-4 gm, approx six times per day.

Storage:

Stored in tightly closed container.

Dental Products

Role of fluoride in dental products.

•Fluoride ion is a trace material that occurs in our body.
•It is mainly obtained from food and water and in small amount, it is obtained from fruits and vegetables.
•Fluoride has beneficial effects in treating dental caries and some types of osteoporosis.

•In some parts of the world, ground water is totally lacking fluoride. In these places, dental caries occur most frequently.
•In such places, to remove dental caries and to provide fluoride ion, fluoride is added to the municipal water supply. This process is known as fluoridation.

•It is also observed that people who receive slow and continuous ingestion of fluoride may suffer from mottling of teeth, increased density of bone, gastric disturbances, muscular weakness, convulsions and even heart failure.

•When fluoride in salt or solution form is taken internally, it is readily absorbed, transported and deposited in the bone or developing teeth and remained fluoride gets excreted by the kidneys.

•The deposited fluoride on the surface of teeth does not allow the action of acids or enzymes in producing injury.

•A small quantity (1 ppm) of fluoride is necessary to prevent caries.
•If more quantity of fluoride (more than 2-3 ppm) is ingested it is carried to bones and teeth and gives rise to mottling in enamel and it is known as **fluorosis**.

•Fluoride can be administered by two routes:
A). Orally and
B). Topically.

•The use of fluoridation in municipal water supply is the common and effective way of oral administration.

•Water supply containing 0.5 to 1 ppm fluoride is sufficient. It can also be given in drinking water or fruit juice in 1 ppm concentration per day.

•Sodium fluoride tablets or solution of sodium fluoride in a dose of 2.2 mg per day are used.
•For topical application, 2% solution is used on teeth.

As fluoride ion found to give effective role in treatment of dental caries and in osteoporosis, this ion plays a chief role in dental products.

Dental Products

- **Eugenol** is an allyl benzene derivative. It is aromatic liquid extracted from oil of clove, nutmeg, cinnamon, basil, etc. It is used topically to treat toothache.
- **Zinc oxide** is used as bulking agent and filler.

- **Zinc oxide eugenol (ZOE)** is a material created by the combination of zinc oxide and eugenol contained in oil of cloves.
- It was first introduced in 1980s.

- When zinc eugenolate chelate forms, it will create an acid-base reaction.
- The reaction is catalysed by water and is accelerated by the presence of metal salts.

- ZOE can be used as a dental filling material or dental cement in dentistry.
- It is often used in dentistry when the decay is very deep or very close to the nerve or pulp chamber.

•Tissue inside the tooth, (pulp), reacts badly to the stimulus like heat and vibration and can cause severe inflammation and precipitation. This condition is known as **acute or chronic pulpitis**.

•This condition usually leads to severe chronic tooth sensitivity or actual toothache.

•Pulpititis can only be treated with the removal of the nerve (pulp) called **root canal therapy**.

•**ZOE cement** gives anti-inflammatory action in this condition.

The chemical composition of ZOE:

Sr. No.	Ingredient	Quantity	Role
1	Zinc oxide	69.0%	Bulking agent and filler
2	White rosin	29.3%	Increases fracture resistance
3	Zinc acetate	1.0%	improves strength
4	Zinc stearate	0.7%	acts as accelerator
5	Eugenol	85%	To treat toothache

•ZOE pastes are dispensed as two separate pastes. One tube contains zinc oxide and vegetable or mineral oil; the other contains eugenol and rosin. The vegetable or mineral oil acts as a plasticizer and helps in removal of irritant action of eugenol.

•Clove oil contains 70% to 85% eugenol and it is used to feel less burning sensation for patients when it contacts the soft tissues.

•The addition of rosin to the paste in the second tube increases the speed of the reaction and yields a smoother, more homogenous product.

•Canada balsam and Balsam of Peru are often used to increase flow and improve mixing properties.

•If the mixed paste is thin then a filler (such as a wax) or an inert powder (such as kaolin, talc, or diatomaceous earth) may be added.

Mechanism:

The exact mechanism of anesthetic effect from ZOE is unknown perfectly, but it gives anti-inflammatory effect and changes immune-cells to less inflamed status.

•It is sometimes used in the management of dental caries as a "temporary filling".

•Zinc oxide eugenol is also used as an impression material during construction of complete dentures (removable plate on the teeth).

•ZOE is not usually used if the patient has large undercuts. In that condition, silicone impression materials would be better option.

•Zinc oxide eugenol is also used as an antimicrobial additive in paint on the teeth.