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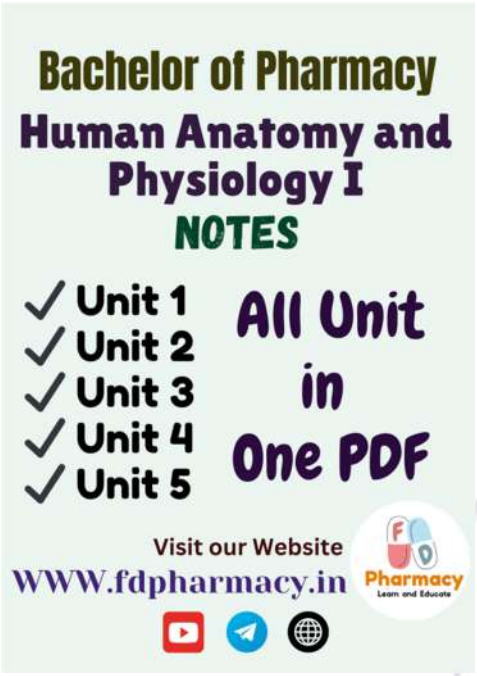
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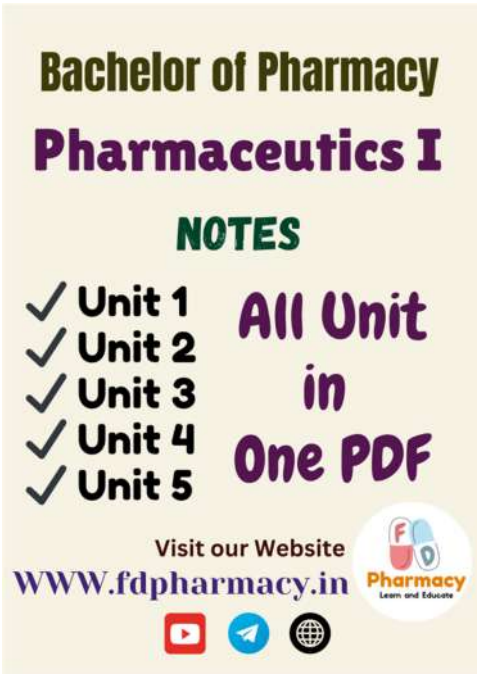
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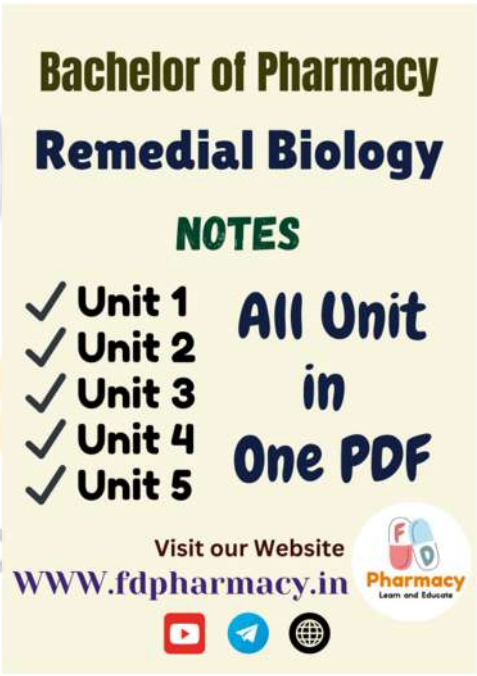
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PHARMACEUTICAL INORGANIC CHEMISTRY

UNIT 2

TOPIC :

- **Dental products :** Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Dental Products

- Dental products are formulations or materials used for the prevention, treatment, and maintenance of oral hygiene. They play a major role in preventing dental caries (tooth decay), reducing sensitivity, cleaning teeth, and repairing damaged parts of the tooth.

Objectives of using Dental Products

- To maintain oral and dental hygiene
- To prevent dental caries (cavities)
- To clean teeth and remove food particles/plaque
- To reduce sensitivity and protect tooth nerves
- To temporarily or permanently restore tooth structure

Classification of Dental Products

- Anti-caries Agents
- Dentifrices (Toothpastes and powders)
- Desensitizing Agents
- Cements and Fillers

1. ANTICARIES AGENTS

Dental Caries

- Dental caries (tooth decay) is a microbial disease that causes destruction of tooth structure due to acids formed by bacteria acting on dietary sugars.
- Microorganisms like *Streptococcus mutans* ferment sugars into acids.
- This acid dissolves calcium and phosphate from the enamel (decalcification), forming cavities.
- Dental caries can be prevented by maintaining oral and dental hygiene.

Anti- Caries Agents

- Anti- Caries Agents are the chemical compounds used to prevent the dental caries produced by action of microorganism.
- Currently flouride is the main anti- caries agent which is used in the treatment of dental caries.

Role of Fluoride in the treatment of Dental Caries

- Fluoride is the most commonly used anti-caries agent.
- Fluoride Occurs naturally in our body and also found in small amounts in a variety of foods.
- When a Fluoride having salt or solution is taken internally, it is readily absorbed, transported and deposited in the bone or developing teeth and remain gets excreted by kidney
- The deposited Fluoride on the surface of teeth prevent the action of acids or enzyme in producing cavities.
- A small quantity (1 PPM) of Fluoride thus becomes necessary to prevent dental caries.
- However more than 2-3 ppm is ingested then it is carried to bones and teeth and cause dental fluorosis.

Administration of Fluoride

Route	Form	Dosage/Use
Oral	Fluoridated water, sodium fluoride tablets	1 ppm/day or 2.2 mg/day (NaF)
Topical	2% Sodium fluoride solution	Applied on teeth using swabs or trays

Sodium Fluoride (NaF)

- **Chemical Formula**: NaF
- **Molecular Weight**: 41.99 g/mol

Preparation

1. **From hydrofluoric acid and sodium carbonate**:

   $2HF + Na_2CO_3 \rightarrow 2NaF + H_2O + CO_2\uparrow$

2. **From calcium fluoride and sodium carbonate:**

   $CaF_2 + Na_2CO_3 \rightarrow 2NaF + CaCO_3\downarrow$

Properties

- White, odorless powder or crystals
- Soluble in water; insoluble in alcohol
- Corrodes ordinary glass; stored in Pyrex bottles

Uses

- Main ingredient in anticaries toothpaste
- Used in fluoride mouthwashes
- Insecticide (non-dental use)

Dentifrices

- A dentifrice is a substance used for cleaning the reachable surfaces of the teeth with a toothbrush.
- The main objective of a dentifrice is to help the toothbrush clean the teeth.
- A dentifrice is used to maintain good oral hygiene.
- Toothpaste is the most common dentifrice that dentists recommend to use with a toothbrush for removing dental plaque and food debris.

Types

Dentifrices are of three types depending on whether they are solid, semi-solid or liquid:

I. **Toothpaste:** It is used with a toothbrush for maintaining oral hygiene. Toothpaste is mainly used for removing debris and plaque. It also has some additional functions, like whitening teeth and freshening breath.

II. **Tooth powder:** It is a substitute of toothpaste and is available in both fluoride and non-fluoride forms.

III. **Mouthwash:** It is available in a variety of compositions, claiming to kill bacteria forming plaque or bad breath, and freshen up breath on regular use

Purpose

- Clean teeth and gums
- Remove food debris and plaque
- Freshen the mouth
- Provide therapeutic agents (e.g., fluoride, antimicrobials)

Properties of a Good Dentifrice

- Mild abrasive for cleaning without damaging enamel
- Non-irritating to oral mucosa

- Should not corrode tooth material
- Provides a refreshing taste and odor
- Compatible with fluoride and other actives

Calcium Carbonate ($CaCO_3$)

- **Synonym**: Precipitated chalk
- **Molecular Weight**: 100.09 g/mol

Preparation

On commercial scale, calcium carbonate is obtained by mixing the boiling solution of calcium chloride and sodium carbonate and allowing the resulting precipitate to settle down.

$$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3\downarrow + 2NaCl$$

Properties

- White, odourless, tasteless powder
- Insoluble in water and alcohol
- Soluble in dilute acids (e.g., HCl)

Uses

- Used as a mild abrasive in dentifrices
- Also used as antacid in gastro medicines
- Polishing agent for dental hygiene

Desensitizing Agents

→ The teeth are usually sensitive to heat and cold
→ During tooth decay, the perception to heat and cold has been felt strongly
→ Desensitizing agents reduce the pain in sensitive teeth Caused by heat or cold, they reduce the Sensitivity of teeth.
→ Act by blocking nerve endings in dentinal tubules
→ Some act as mild local anesthetics

Zinc Chloride ($ZnCl_2$)

- **Molecular Weight**: 136.28 g/mol

Preparation

It is prepared by heating granulated zinc with MCI

$Zn+2HCl \rightarrow ZnCl_2+H_2\uparrow$

Properties

- White crystalline, odorless solid
- Soluble in water and alcohol

Uses

- Acts as desensitizing agent
- Used in dental fillings
- Also has antiseptic properties

Cements and Fillers

→ Dental cements are materials that are applied as pastes to fill, line, or seal cavities and harden over time to protect the treated area.

They may be:

- **Temporary** (e.g., after dental cleaning/surgery)
- **Permanent** (e.g., permanent filling materials)

Zinc Eugenol Cement

- One of the most commonly used dental cements
- Low-strength, used for temporary fillings
- Contains eugenol (from clove oil) – a mild analgesic and antiseptic

Composition

- Zinc Oxide
- Eugenol (or clove oil)
- Olive oil (sometimes)

Properties

- Soothing to inflamed dental tissues
- Has a calming effect on tooth nerves
- Easy to apply and remove

➤ ***Uses***

- Temporary dental fillings
- Lining under metallic restorations
- Post-operative protection for cavities