Unit-4

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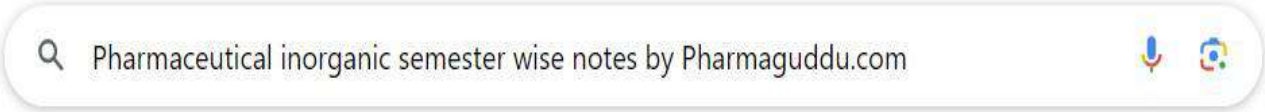

Expectorants

Expectorants are drugs used to help in the removal of sputum from the respiratory tract, or simply put, they are used in the treatment of cough.

- Cough is a protective physiological reflex that helps to clear the respiratory tract.
- Cough can be further divided into two types:
  1. Dry Cough (No sputum discharge)
  2. Productive Cough (Sputum discharge)

Classification of Expectorants

Expectorants act by two mechanisms:

- Increasing fluidity (or reducing viscosity) of sputum.
- Increasing the volume of sputum.

Based on these mechanisms, expectorants can be classified into two categories:

1. Sedative Expectorants
2. Stimulant Expectorants

1. Sedative Expectorants

- These are stomach irritant expectorants.
- They produce their effect by increasing gastric reflexes.
- They cause sedation (sleep) in patients.
- Therefore, they act by increasing the volume of sputum.

2. Stimulant Expectorants

- They act by stimulating the secretory cells of the respiratory tract directly or indirectly.
- These drugs stimulate secretion, leading to more fluid production in the respiratory tract, which dilutes the sputum and makes it easier to discharge through coughing.
- Hence, these drugs act by increasing the fluidity of sputum (or reducing its viscosity).

Potassium Iodide

- Molecular Formula: KI
- Molecular Weight: 166 g/mol
- Synonyms: Kalium Iodatum

Method of Preparation

When hydrogen iodide is treated with potassium bicarbonate, it results in the formation of potassium iodide.

$$KHCO3+HI \rightarrow KI+H2O+CO2$$

Properties

- It occurs as colorless or transparent crystals or white granular powder.
- It is odorless.
- It is bitter in taste.
- It is hygroscopic in nature.
- It is soluble in both water and alcohol.

Uses

- It is used as an expectorant.
- It is used as an antifungal agent.
- It is used as an iodine supplement.
- It is also used as a saline diuretic.

Ammonium Chloride

Note: Ammonium chloride properties, uses, and method of preparation are already covered in Acidifiers. check, UNIT-II.

Assay of Ammonium Chloride

Ammonium chloride is assayed by precipitation titration using Volhard's Method (Previously).

Procedure

1. An accurately weighed 0.2 g of ammonium chloride is dissolved in 40 mL of water.
2. The solution is acidified with 3 mL of nitric acid.
3. The solution is shaken vigorously after adding 50 mL of 0.1 N silver nitrate and 5 mL of nitrobenzene.

4. The excess of silver nitrate is titrated with *0.1 N* ammonium thiocyanate using 2 mL of ferric ammonium sulfate as an indicator.

$NH_4Cl + AgNO_3 \rightarrow NH_4NO_3 + AgCl$

Each mL of 0.1N $AgNO_3$ ≈ 0.005349 g of NH_4Cl

Note: The above assay method was previously used. Nowadays, ammonium chloride is assayed using Acid-Base Titration.

Emetics

- **Definition**: Emetics are drugs that cause vomiting (emesis).
- **Mechanism:**
  - Vomiting is a forceful expulsion of the stomach's contents via the mouth or sometimes through the nose.
  - Emetics plays a valuable role in the treatment of poisoning.
  - They are also used in the treatment of drug overdose or adverse drug effects.
  - In low doses, emetics are sometimes added to cough preparations to stimulate the flow of respiratory tract secretions.
  - Vomiting is an involuntary process.

Mechanism of Action of Emetics:

- Emetics generally act through two mechanisms:
  1. Direct Action: By stimulating the chemoreceptor trigger zone located in the medulla oblongata in the brain.

2. **Indirect Action:** By causing irritation in the gastrointestinal tract.

Copper Sulphate

- Molecular Formula: $CuSO_4 \cdot 5H_2O$
- Molecular Weight: 159.6 g/mol
- Synonyms: Blue Vitriol

Method of Preparation:

- Copper sulphate is prepared by dissolving cupric carbonate in dilute H_2SO_4

$$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$$

Properties:

- Appears as blue crystalline granules or in powdered form.
- It is odorless.
- It is soluble in water.
- It is insoluble in alcohol.

Assay:

- The assay of copper sulphate is performed by Redox Titration.
- An accurately weighed quantity of $CuSO_4$ is dissolved in water.
- To this solution, excess potassium iodide is added, followed by acetic acid.
- The liberated iodine is titrated with standard sodium thiosulphate solution using starch solution as an indicator.

- The titration continues until the blue color of the solution disappears.

Uses:

- Used in the preparation of emetics.
- Also used as germicides and insecticides.

Sodium Potassium Tartrate

- Molecular Formula: $C_4H_4NaKO_6$
- Molecular Weight: 210.158
- Synonyms: Rochelle Salt

Preparation:

- First, sodium carbonate is added to a suspension of potassium tartrate.
- The mixture is then heated by boiling and allowed to cool.
- Crystals of sodium potassium tartrate form.

Properties:

- Appears as a white or colorless crystalline powder.
- It is odorless.
- It has a saline taste.
- It is soluble in water.
- It is insoluble in alcohol.

Uses:

- Used as an emetic.
- Also used as a laxative.

- Used in effervescent powders.

Haematinics

- **Definition:** Haematinics are substances required for the formation of blood and are mainly used in the treatment of anemias.
- **Function:**
  - These drugs increase the number of red blood cells and the amount of hemoglobin when they are below normal levels.
  - Anemia occurs when the balance between the production and destruction of red blood cells gets disturbed.

Anemia:

- Definition: Anaemia is a state of the body where the concentration of hemoglobin is reduced in the blood.
- **Causes:**
  1. Excessive blood loss
  2. Unhealthy RBC formation
  3. Increased destruction of RBCs

Types of Anaemia:

- Iron Deficiency Anaemia
- Aplastic Anaemia
- Haemolytic Anaemia
- Sickle Cell Anaemia
- Pernicious Anaemia

Ferrous Sulphate

- Molecular Formula: $FeSO_4 \cdot 7H_2O$
- Molecular Weight: 278 g/mol
- Synonyms: Green Vitriol

Method of Preparation:

- When iron is treated with dilute H_2SO_4, iron dissolves and forms ferrous sulphate, releasing hydrogen gas: $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

Properties:

- Occurs as transparent green crystals or pale bluish-green crystalline powder.
- It is odorless.
- It has a metallic taste.
- It is soluble in water.
- It is insoluble in alcohol.

Assay:

- The assay of ferrous sulphate is performed using Redox Titration.
- Add about 0.76 g of $FeSO_4$ in 100 ml of water.
- Add 0.1 ml of 3-drop H_2SO_4 as an indicator.
- Titrate with 0.1 N $KMnO_4$ standard solution until the purple color disappears.

Uses:

- Used as haematinics.

- Also used as disinfectants.

Poison & Antidote

Poison:

- **Definition:** Poison is defined as any substance administered in whatever way (by mouth or by injection) that produces illness or can even cause death.
- The diagnosis of poisoning is often difficult.

Classification of Poisoning:

1. **Intentional Poisoning:** A person taking or giving a substance with the intention of causing harm to that person (e.g., suicide, assault).
2. **Unintentional Poisoning:** A person taking or giving a substance without knowing its toxic effect (accidentally).
3. **Undetermined:** When the reason behind poisoning is not determined.

Other Causes:

- Food Poisoning
- Overdose of Drugs
- Cyanide Poisoning

Symptoms of Poisoning:

- Reduced breathing rate
- Vomiting
- Diarrhea

- Dilated pupils
- Decreased heart rate

Cyanide Poisoning

- **Occurrence:**
  - Cyanide poisoning can occur by accidentally taking cyanide poison.
  - Cyanide poisoning can also occur intentionally as a means to commit suicide.
- **Mechanism:**
  - Cytochrome Oxidase is an enzyme responsible for electron transfer reactions necessary for cellular respiration.
  - In cyanide poisoning, cyanide binds with the ferric ion of cytochrome oxidase.
  - This binding leads to the stoppage of electron transfer reactions, ultimately inhibiting cellular respiration.
  - If cyanide poisoning is not treated immediately, it can be very harmful and potentially fatal.
- **Treatment:**
  - Sodium nitrite and sodium thiosulphate injections are administered, one after the other, as antidotes for cyanide poisoning.

Antidotes

- **Definition:**
  - Antidotes are substances that specifically react with ingested poison to neutralize its effects.

    - They are used to neutralize the effects of poison in the body.
- **Classification:**
    - Antidotes are classified based on their mechanism into three categories:
        1. Physiological Antidotes
        2. Chemical Antidotes
        3. Mechanical Antidotes

Physiological Antidotes:

- Also called Antagonists.
- They produce effects opposite to that of the poison.
- Example: Sodium nitrite.

Chemical Antidotes:

- They act by combining with the poison, changing its chemical structure, or converting it into an inactive or harmless compound.
- Example: Sodium thiosulphate.

Mechanical Antidotes:

- They act by preventing the absorption of poison into the body.
- Example: Activated charcoal.

Sodium Thiosulphate

- Molecular Formula: $Na_2S_2O_3 \cdot 5H_2O$
- Molecular Weight: 248.2 g/mol

- Synonym: Sodium Hyposulphate

Preparation:

- Sodium thiosulphate can be prepared by boiling sodium sulphite with sulfur.

$Na_2SO_3 + S \rightarrow Na_2S_2O_3$

Properties:

- Occurs as large colorless crystals.
- It is odorless and has an alkaline taste.
- Soluble in water.
- Insoluble in alcohol.

Assay:

- The assay of $Na_2S_2O_3$ is based upon redox titration:
  - Take about 0.5 g of the sample and dissolve it in 20 ml of water.
  - Titrate it against 0.05 M iodine using starch as an indicator.
  - Continue titration until the blue color of the solution disappears.

Uses:

- It is used in the treatment of cyanide poisoning.
- It is also used to treat skin diseases.

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