POISON AND ANTIDOTES

Poison

A poison may be defined as any substance administered in whatever way (by mouth, injection, inhalation, skin, mucous membrane) produces ill health, disease or death.

The diagnosis of poisoning is often difficult. But acute poisoning may be accidental, occupational, suicidal or criminal. Self-medication is also a major cause of drug poisoning.

Antidote

Antidotes are the substance that counteract the effect of poison or neutralize the effect of poison.

Classification of antidote

According to their mode of action, they are classified as:

- Physiological antidote
- Chemical antidote
- Mechanical antidote

1. Physiological Antidotes:

They are also called antagonists. They produce the effect opposite to that of the poison. They are used after same of the poison is absorbed in the circulation. e.g. Sodium nitrite used in cyanide poisoning.

2. Chemical Antidotes:

They react by combining with the poison and change its chemical nature by converting the poison into inactive' or harmless compounds. e.g. Sodium thiosulphate which convert the toxic cyanide into thiocyanate.

3. Mechanical Antidotes:

They act by preventing the absorption of poison into the body or expel out the poison by emesis or eliminate through urine. eg. Activated charcoal absorbs the poison prior into intestinal wall.

Sodium Nitrite

Molecular Formula: $NaNO_2$

Molecular Weight: 69 g/mol

Synonymn: Nitrous acid Sodium Salt

Standard: It contains not less than 97% and not more than 101% of sodium nitrite calculated on dried basis.

Preparation:

1. It is prepared by strongly heating sodium nitrate.

$$\mathbf{2NaNO_3 \rightarrow 2NaNO_2 + O_2}$$

2. It can also be prepared by heating sodium nitrate with lead.

$$\mathbf{NaNO_3 + Pb \rightarrow NaNO_2 + PbO}$$

Physical Properties:

- It is yellow or white crystalline powder.
- It has saline taste.
- It is freely soluble in water but less soluble in alcohol.
- It is odourless in nature.

Chemical Properties:

When it is exposed to air, it readily forms sodium nitrate.

$$\mathbf{2NaNO_3 \rightarrow 2NaNO_2 + O_2}$$

Uses:

- It is mainly used in cyanide poisoning.
- It is also used in anti-rust solution to prevent the rusting of surgical instruments.
- Sodium nitrite relaxes vascular smooth muscles and provide vasodilator action.

Sodium Thiosulphate

Molecular Formula: $Na_2S_2O_3.5H_2O$

Molecular Weight: 248.18 g/ mol

Synonyms: Sodium hyposulfite, Anti-chlor

Standards: It contains not less than 99% and not more than 101% of $Na_2S_2O_3.5H_2O$

Preparation:

1. It can be prepared by boiling sodium sulphite with sulphur.

$$Na_2SO_3 + S \rightarrow Na_2S_2O_3$$

2. It can also be prepared by passing SO, gas in a mixture of sodium sulphide (8%) and sodium carbonate (6%).

$$2Na_2S + Na_2CO_3 + 4SO_2 \rightarrow 3Na_2S_2O_3 + CO_2\uparrow$$

3. It can also be prepared by passing sulphur dioxide into sodium sulphide solution.

$$2Na_2S + 3SO_2 \rightarrow 2\ Na_2S_2O_3 + S$$

Physical Properties:

- It occurs as large, transparent prismatic crystalline powder.
- It effervesces in dry air.
- It is practically soluble in water and insoluble in alcohol.
- It starts melting at 50°C and at 100°C, loses its all moles of water.

Chemical Properties:

1. Its aqueous solution decomposes slowly as:

$$4Na_2S_2O_3 \rightarrow 3Na_2SO_4 + Na_2S \rightarrow Na_2S + 4S$$

2. Barium chloride reacts with sodium thiosulphate solution to give white precipitate of barium thiosulphate.

$$Na_2S_2O_3 + BaCl_2 \rightarrow BaS_2O_3 + 2NaCl$$

Assay:

Principle

The assay of $Na_2S_2O_3$ is based on iodometric titration. In this titration, solution of $Na_2S_2O_3$ is titrated with iodine directly.

$$2\ Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$$

Procedure

Weigh about 0.5 gm of the sample and dissolve in 20 ml of water, and the solution is titrated against 0.05 M iodine using starch solution as an indicator, when at the end point, the excess iodine reacts with starch paper turning it to a blue colour.

Uses:

- It is used as antidote in cyanide poisoning intravenously after the injection of sodium nitrite.
- It is used as a standard titrant in iodimetric analysis.
- Topically, it is used as an anti-fungal agent.
- It is also effective antidote in lead, bismuth, mercury and iodine poisoning.
- It is also used as a fixer in photographic work.
- In textile industry, it is used as antichlor in bleaching process.

Activated Charcoal

Charcoal is a black residue consisting of carbon and any remaining ash obtained by removing water and other volatile constituent from animal and vegetable substances.

Preparation:

1. It is prepared by burning wood in absence of air. The residue obtained consists of nearly pure carbon.

2. Activation of Charcoal: The absorptive power of charcoal could be tremendously increased by treating it with various substances such as steam, air, carbon dioxide, oxygen, zinc chloride, sulphuric acid, phosphoric acid or a combination of these substances, at temperature ranging from 500-9000°C.

3. Other sources: Sucrose, lactose, rice, starch, coconut, pericarp, bone, blood and various industrial wastes can be used for preparing charcoal.

Properties:

- It is fine, black, odourless and tasteless powder.
- It is free from gritty matter.
- It is insoluble in water and other organic solvents.

Uses:

- It is used as an emergency antidote in many forms of poisoning.
- It is used as protective and adsorbent.
- It is also used as a burning fuel.
- Due to its high surface area, it is also used as a filter-aid.
- It is also a constituent for gum powder.
- It is used as disinfectant in wounds.
- Its antidote activity is also reported in cases of spider, insect and snake bites.
- It is used in overdose of aspirin.