POISONS AND ANTIDOTES

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

OR

It may be defined as any substance that leads to unwanted effects on human body.

- The most common poisoning occurs because of heavy metals as the environment is getting richer in heavy metals or metallic contamination of food or water.
- The poisoning can also occur because of insecticides or pesticides. Sometimes, metal gets leached from eating utensils and cookware.
- The poisoning may also occur because of excessive use of drugs i.e.; over dosage of drugs.

Classification of poisoning:

1. **Intentional poisoning:** A person taking or giving a substance with intention of causing harm to that person. **Eg:** Suicide, assault.
2. **Unintentional poisoning:** if the person taking or giving a substance without knowing its toxic effects. **Eg:** Accidentally
3. **Undetermined:** when the distinction between intentional and unintentional is not clear. **Eg:** Poisoning due to insecticides or pesticides.

Signs and symptoms of Poisoning:

1. Reduced breathing rate
2. Nausea, vomiting and diarrhea
3. Increased or decreased heart rate
4. Dilated or shrunken pupils
5. Muscle cramps
6. Partial consciousness.

Antidotes: Antidotes are the substances which react specifically with the ingested poison or toxic substance or with potent drugs in case of overdose.
They are used to neutralize the effect of poison in the body.

Classification: According to mechanism of action, they are classified as:

1. **Physiological antidotes:** They are also called as antagonists. They produce the effect opposite to that of the poison. They are used after some of the poison is absorbed in the circulation. **Eg:** 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. **Eg:** Sodium thiosulphate, EDTA

3. **Mechanical antidotes:** They act by preventing the absorption of poison into the body or expel out the poison by emesis or eliminate or eliminate through urine. **Eg:** Activated charcoal, copper sulphate, magnesium sulphate and sodium monohydrogen phosphate.

Antidotes for selected unabsorbed inorganic poisons and drug overdose:

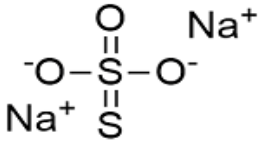
Poison or drug over dose	Antidote	Mechanism
Acid (Corrosive)	Antacid or weak alkali (Milk of magnesia). Avoid inducing vomiting	Chemical antagonism. Acid base neutralization
Alkalis (Caustics)	Weak acid (lemon juice or diluted vinegar)	Chemical antagonism. Acid base neutralization
Iron salts	Desferroxamine, sodium carbonate, 1% lavage	Chelation
Copper and lead salts	Pencillamine	Chelation
Mercury salt	Dimercaprol	Chelation

Sodium thiosulfate : ($Na_2S_2O_3.5H_2O$)

Synonyms: Sodium hyposulfite, Anti-chlor
Molecular weight: 248.18 gm/mol
Standards: It contains not less than 99% and not more than 101% of $Na_2S_2O_3.5H_2O$

Properties:

- **Appearance:** It occurs as a large, transparent prismatic crystalline powder.
- **Solubility:** Soluble in water and insoluble in alcohol
- **Melting point:** It starts melting at 50^0C and 100^0C
- It effervesces in dry air



Sodium thiosulfate

Preparation:

1. Sodium thiosulphate is prepared by reacting sodium hydroxide with sulphur

$$\underset{\text{(Sodium hydroxide)}}{\mathbf{6NaOH}} + \underset{\text{(Sulphur)}}{\mathbf{4S}} \longrightarrow \underset{\text{(Sodium thiosulphate)}}{\mathbf{Na_2S_2O_3}} + \underset{\text{(Sodium sulphide)}}{\mathbf{2Na_2S}} + \mathbf{3H_2O}$$

2. It is prepared by passing SO_2 gas in a mixture of sodium sulphide (8%) and sodium carbonate (6%)

$$\underset{\text{(Sodium Sulfide)}}{2Na_2S} + \underset{\text{(Sodium carbonate)}}{Na_2CO_3} + \underset{\text{(Sulpur dioxide)}}{4SO_2} \longrightarrow \underset{\text{(Sodium thiosulphate)}}{3Na_2S_2O_3} + CO_2$$

Assay: Its assay is based upon iodometric titrations

- Take about 0.8gm of sample and dissolve in 30mL of water
- The solution is titrated against 0.1N iodine using starch as an indicator
- At the end point, the excess iodine reacts with starch paper turning it to blue color.

$$\underset{\text{(Sodium thiosulphate)}}{2Na_2S_2O_3} + \underset{\text{(Iodine)}}{I_2} \longrightarrow \underset{\text{(Sodium tetrathionate)}}{Na_2S_4O_6} + \underset{\text{(Sodium iodide)}}{2NaI}$$

Each mL of 0.1N iodine is equivalent to 0.02482 gm of $Na_2S_2O_3$

Mechanism of action: After 5min of sodium nitrite injection, a slow I.V of sodium hiosulphate is given which causes dissociation of cyanometh haemoglobin and set free cyanide ion. This cyanide ion is converted into thiocynate ion by sodium thiosulphate in the presence of enzyme Rhodanese and thiocyanate ion is then excreted out from body by kidney.

Uses:

- It is used as an anti oxidant with solutions containing iodides
- It is used as a standard titrant in iodimetric analysis
- It is used in cyanide poisoning intravenously after the injection of sodium nitrite.
- It is used as anti-fungal agent
- It is used as effective aantidote in lead, bismuth, mercury and iodine poisoning
- In textile industry, it is used as a antichlor in bleaching process.

Dose: The I.P recommended dose of injection which is equivalent of 0.3-1.0gm (3-10mL) and is admininstered by I.M and I.V route

Storage: Sodium thiosulphate injection should be stored in tightly closed containers and container must be single dose.