UNIT III

Pharmaceutical Inorganic Chemistry

Gastrointestinal Agents

Presented by…

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Gastrointestinal Agents

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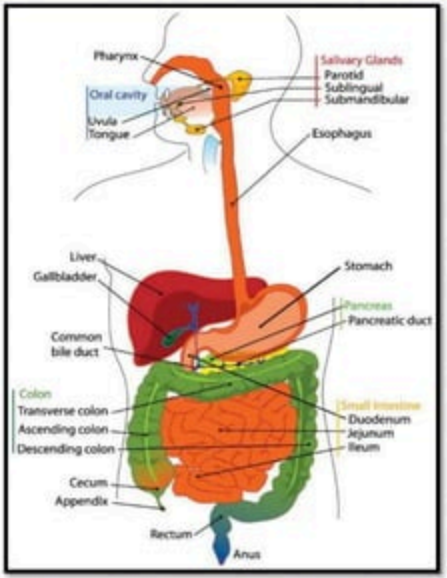
GASTROINTESTINAL SYSTEM



The **gastrointestinal system** includes the mouth, pharynx (throat), esophagus, stomach, small intestine, large intestine, rectum, and anus. It also includes the salivary glands, liver, gallbladder, and pancreas, which make **digestive** juices and enzymes that help the body digest food and liquids.

One of the vital organ present in the body

- Controls hormones and other secretions.
- Consists of structures that aid in the ingestion and digestion of food by means of enzymatic breakdown/biochemical process.

Ingestion: process of consuming something and taking it into the body.

Digestion: mechanical & chemical breaking down of food into smaller components to a form that can be absorbed.

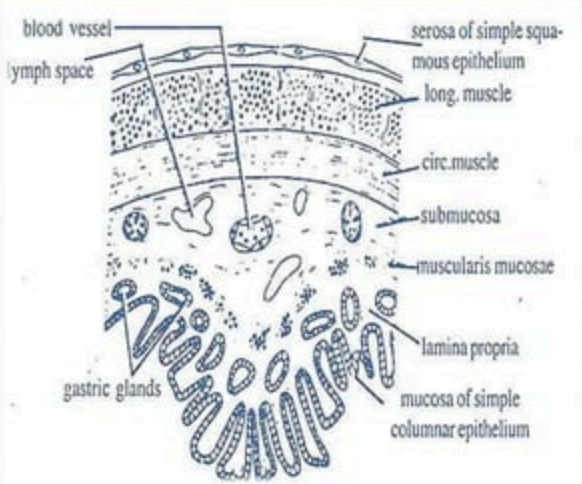
Disfunctioning of any one of the GIT compartments may lead to human illness and discomfort

Made up of 5 layers of smooth muscles:

- The mucus lining of the stomach protects the stomach walls from the action of stomach acid
- The walls of the stomach are lined with parietal cells that secrete mucus, gastric juice [pepsin (an enzyme) or pepsinogen & HCl]

Peptic Ulcer:

- The serious complication of hyperacidity
- Due to the digestive action of pepsin & HCl on the inner wall of stomach & duodenum.
- Due to the failure of protective mechanisms of mucosa to prevent auto digestion process.



STOMACH-TS(rabbit)

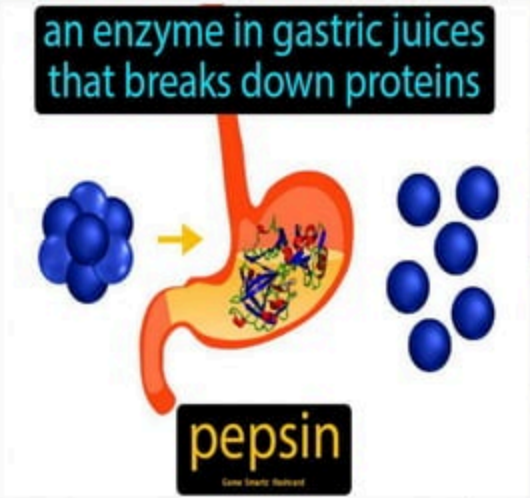
PEPSIN VS HCL

Pepsin is most effective in the very acidic condition of the stomach (pH 2.0)

It become inactive at higher pH.

Thus, HCl present in the gastric juice (secreted by the oxyntic (or parietal) cells of the stomach)

- ✓ Acidifies the food
- ✓ Kills many microbes which may be harmful to the body, and
- ✓ Provides the acid environment needed for effective digestion by pepsin.

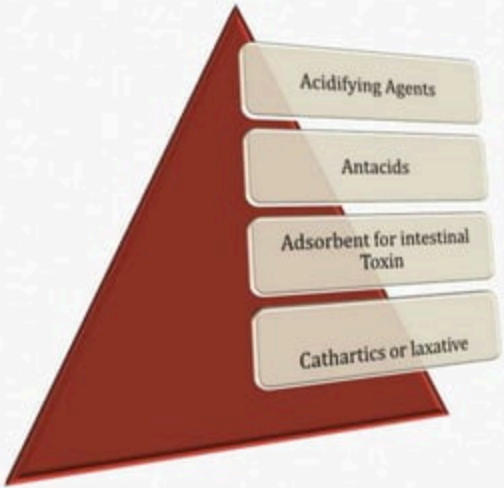


Secretion of Gastric juice/HCl

- HCl secretion is under the control of bases i.e., acetylcholine, histamine, and gastrin (a 17 amino acids substance heptadecapeptide) through an interlinked mechanism and by respective receptor sites.
- H+ - K + ATPase Pump: the release of gastric acid (i.e., intracellular hydrogen ions) occurs through this pump by 1 to 1 exchange with luminal K + ions.

➢ It is an energy dependent process

➢ Cyclic AMP & Calcium ions Stimulate this pump to secret gastric acid



ACIDIFIERS OR ACIDIFYING AGENTS

Acidifying agents are used in a condition when there is absence or insufficient secretion of hydrochloric acid in stomach, which leads to a disease called achlorhydria or hypochlorhydria.

Achlorhydria Occurs because of two reasons.:

(a) when the gastric acid secretion is devoid of HCI, even after stimulation with histamine phosphate

(b) when the gastric secretion is devoid of HCI, but secreted upon stimulation with histamine phosphate.

The gastric hydrochloric acid secreted by the stomach walls, kills the bacteria in the ingested drink/food, soften fibrous food and helps in the secretion of pepsin (proteolyticenzyme)

Pepsinogen is converted in to pepsin when the gastric PH is below 6. not only this pepsin shows its best action below PH 3.5 thus the gastric acid (HCI) can cause lack of pepsin activity. This finally leads to impairment digestion.

pepsinogen $\xrightarrow{\text{p H below 6}}$ **pepsin**

These are categorized into four types:

1. Gastric Acidifiers: Drugs which are used to restore the acidity of stomach in patients suffering from achlorhydria or hypochlorhydria.

2. Urinary Acidifiers: These are the drugs which are used to retain acidity of urine to enable treatment of some type of urinary tract disorders .

3. Systemic acidifiers : Drugs which are able to neutralize the alkaline body fluids , particularly blood in patients suffering form systemic alkalosis.

4. Acids: these are used as pharmaceutical aid in the preparation laboratory quality control etc.

Caution: Achlorhydria patients are very sensitive to spicy food .

Treatment: the best agent to treat achlorhydria is dilute hydrochloric acid.

AMMONIUM CHLORIDE

Molecular Formula: NH4cl

Molecular Weight : 53.49 g/mole

Synonyms: salmiac Amchlor muriate

Standards: It contains not less than 99.5% of ammonium chloride calculated with reference to dried substance.

Category:

Systemic acidifier, expectorant and diuretic

Description: Hygroscopic white crystalline powder.

- ***Solubility:*** Soluble in water, alcohol & glycerine

NH4Cl act by stimulating the gastric reflexes (causing irritation by ammonia/amine gas)

$HCl \rightarrow H+ + Cl$

$NH4Cl \rightarrow NH3 + HCl$

- ***Preparation:*** Ammonium chloride is made by reacting hydrochloric acid with ammonia the solution is evaporated to dryness and the product is purified by recrystallization.

$$NH3 + HCl \rightarrow NH4Cl$$

It is prepared by neutralizing hydrochloric acid with ammonia

- ***Doses:*** it is given 3- 6 g per day in divided doses.

AMMONIUM CHLORIDE

Physical Properties:

1. It is a white fine crystalline powder.
2. It is odourless and has cooling saline taste.
3. It is hygroscopic in nature .
4. It is freely soluble in water but slightly soluble in alcohol.
5. Its 0.8% w/v solution is isotonic with serum.

Chemical Properties :

1. In its vapour form it dissociates in ammonia and hydrochloric acid:

$$NH_4Cl \longrightarrow NH_3 + HCl$$

Ammonium chloride — Ammonia — Hydrochloric acid

Assay:

It is assayed by acid-bass titrations . The neutral formaldehyde solution is added so that ammonium chloride will be converted to methanimine and hydrochloric acid the liberated acid is titrated with 0.1 N NaOH using phenolphthalein as an indicator .

$$NH_4Cl + HCHO \longrightarrow CH_2{-}NH + HCl + H_2O$$

Ammonium chloride — Formaldehyde — Methanimine — Hydrochloric acid

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

Hydrochloric acid — Sodium hydroxide — Sodium chloride

AMMONIUM CHLORIDE

Assay 1:

• A modified volhard method I.P. A solution of the substance acidifies with nitric acid is shaken with a measured volume of n/10 silver nitrate, nitrobenzene being previously added in order to coagulate the precipitate of silver chloride, so that it will not interfere with the titration later of excess of silver nitrate which is determined by titration with N/10 ammonium thiocyanate, using ferric ammonium sulphate as indicator.

$AgNO3 + NH4Cl \rightarrow AgCl + NH4NO3$

$AgNO3 + NH4SCN \rightarrow AgSCN + NH4NO3$

Ammonium thiocyanate Silver thiocyanate

• The following is the reaction taking place at the end point when red ferric thiocyanate is formed (by reaction of ammonium thiocyanate with the indicator ammonium sulphate).

$FeNH4(SO4)2 + 3NH4SCN \rightarrow Fe(SCN)3 + 2(NH4)2SO4$

Each 1ml of 0.1 N NaOH=0.05349g of ammonium chloride

AMMONIUM CHLORIDE

Incompatibility : It is incompatible with alkali alkaline earth metals carbonates and metal salts of lead and silver.

Identification tests:

1. It gives the reactions of ammonium salts and chlorides .

2. A few mg of the substance is heated with sodium hydroxide solution leading to the evolution of ammonia gas which is recognizable by its odour and by its action on moist red litmus paper.

$$NH_4 + OH \longrightarrow NH_3 + H_2O$$

Ammonium ions — Hydroxyl ions — Ammonia

Test for purity:

The sample is tested for the presence of following impurities:

- ✓ Arsenic should not be more than 2 ppm.
- ✓ Sulphate should not be more than150 ppm. And calcium should not be more then 200 ppm.
- ✓ Iron should not be more 20 ppm.
- ✓ Heavy metals should not be more than10 ppm.
- ✓ Loss on drying should not be more than 1%.

Storage: It should be stored in well closed containers.

Dose: 3- 6g daily in divided dose

AMMONIUM CHLORIDE

Uses:

1. ***As Systemic Acidifier:*** It is helpful in producing mild acidosis at a dose of 2g orally It gets rapidly absorbed and converted into urea in the liver the decrease in pH of urine occurs due to the liberation of its anion into the blood stream and extracellular fluids.
2. ***As Expectorant:*** It is used as an ingredient in expectorant cough mixtures in doses of 300mg to 1g.
3. ***As Diuretic:*** It is given for its diuretic action especially to help the excretion of over dosage of basis drugs such as amphetamine and in the treatment of lead poisoning by increasing its excretion.

Hydrochloric Acid

Molecular Formula: HCl

Molecular weight: 36.5g

Synonyms: muriatic acid spirit of salt

Standards: It contains not less than 35%w/w and not more than 38%w/w HCl

Method of Analysis: Dil HCl

- It is analyzed on the principle of 'acid-base titration'.
- An accurately weighed quantity (4.0g to 6.0g), add 30 ml of distilled water mix & titrate against 1.0 N NaOH solution using methyl orange as an indicator.

$HCl + NaOH \rightarrow NaCl + H_2O$

Test for Identification:

1) When added to $KMnO_4$ with dilute nitric acid, chlorine is evolved.
2) To acidified solution add silver nitrate solution, shake and allow to stand, curdy white precipitate is formed, which is insoluble in HNO_3 (Limit test for chloride), but soluble after being washed with water in ammonium hydroxide from which it is re-precipitated by the addition of HNO_3.

Each ml of 1.0 N NaOH solution is equivalent 0.03646g of HCl

Uses: **Acidifier**

Dilute Hydrochloric Acid

- Normal HCl: 1.5 to 2.0 mEq
- In females, the acidity is proportionally lower than in males.
- Under certain pathological conditions the gastric acid content is very low 'hypochlordydria' or it may be totally missing 'achlorhydria', - need for Acidifiers or Acidifying Agents

e.g., Ammonium chloride, Ca chloride, Dilute HCl etc

- Dilute HCl I.P. - It is colour less aqueous solution & acidic to litmus.
- Recommended to relieve the patients suffering from achlorhydria.
- I.P. Limit: It contains not less than 9.5% and not more than 10.5% w/w of HCl.

Preparation:

1. When 5.0ml of dilute HCl is added to 200ml of water, it provides about 15 mEq of dil. HCl acid
2. It is prepared by mixing 274gm of HCl and 726 gm of purified water (Ref. I.P.).

Hydrochloric Acid

Ingredients:

Hydrochloric acid	274.0g
Purified water	726.0g

Properties:

1. It is a colourless liquid.
2. It is strongly acidic in diluted form also.
3. It has a specific gravity of 1.04 to 1.05.

Identification Tests:

1. It gives all the reactions of chloride ion (CI-)
2. when potassium permanganate is added into hydrochloric acid chlorine gas is evolved.

Storage conditions:

it should be stored in well closed container of glass or other material at a temperature not more than 30°C

Uses:

1. It is used as a pharmaceutical aid.
2. It is used as an acidifying agent (acidifier) when the level of hydrochloric acid in the gastric juice is low.
3. It is used as a solvent.
4. It acts as a catalyst in basic pharmaceuticals.

Dose: 0.6 – 8ml, usually 5ml dose of dil. HCl added to 20ml of water provides about 15 mEq of the acid.

Dilute HCl

Assay:

An accurate amount, 10g of HCl is transferred to a stoppered flask which is having 40ml water. Now, this solution is titrated with 1N NaOH, using methyl orange as an indicator.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

Sodium hydroxide — Hydrochloric acid — sodium chloride

Each 1ml of NaOH = 0.03646g of HCl

Caution: Drinking straw is recommended in case of dill HCl to avoid the direct exposure of HCl with dental Enamel, as it can get scratched.

Dose: About 0.6 to 8.0 ml

- ✓ The acid should be diluted with 25-50 volumes with water or juice and sipped through a glass tube to prevent reaction upon dental enamel.
- ✓ It is taken during or after meals given in conjunction with iron therapy in hyper chromic anemia.

Peptic Ulcer & Hyperacidity

The most common causes of **peptic ulcers** are:

- ✓ infection with the bacterium Helicobacter pylori (H. pylori)
- ✓ and long-term use of nonsteroidal anti-inflammatory drugs (NSAIDs)
- ✓ such as ibuprofen (Advil, Motrin IB, others) and naproxen sodium (Aleve).
- ✓ Stress and spicy foods do not **cause peptic ulcers**.

The goals in Peptic Ulcer treatment:

- To reduce pain
- To accelerate healing rate
- To prevent complications
- To prevent ulcer recurrence
- To prevent Gastric Hyperacidity

Gastric Antacids

Agents used to neutralize the excess of gastric acid secretion – Antacids

- E.g. $NaHCO_3$, $CaCO_3$, $Al(OH)_3$, $Mg(OH)_2$, $MgCO_3$

ANTACIDS

- Antacids are weak bases
- The purpose is to raise the pH to about 4 ($NaHCO_3$ may even elevate the pH to 7) without producing systemic alkalosis
- Systemic antacids (alkalotic agents): capable of changing pH of the blood & causes systemic alkalosis
- E.g. $NaHCO_3$ & Sodium citrate Side-effects: Nausea, Vomiting, Diarrhea, Abdominal pain, Headache, Irritability, Insomnia etc

Uses: use to combat/maintain acidosis [systemic acid base balance (acid-base equilibrium) of the blood]

Non-systemic antacids (local antacids):

- They are insoluble in water
- Absorption rate is less due to their cationic nature
- No direct effect upon the systemic acid base balance (acid-base equilibrium) of the blood
- *E.g.* Aluminum hydroxide and Magnesium hydroxide & Mg trisilicate etc
- **Uses:** in the treatment of peptic ulcer & hyperacidity

ANTACIDS

These are the alkaline substances which on intake, react whit the gastric acid neutralize it and lower the acidity of gastric content.

Gastric acidity can result in:

- Gastritis: inflammation of gastric mucosa
- Gastric ulcer
- Duodenum ulcers

Ideal characteristics of Antacids:

1. It should be insoluble in water and has fine particle form.
2. It should not get absorbed otherwise they can cause systemic alkalosis.
3. It should not liberate carbon dioxide.
4. It should neither be laxative nor be constipatory in action.
5. It should be quick acting and exert its effect for a longer period of time.
6. It should be stable and easily available.
7. The antacid should buffer in the Ph range of 4-6
8. It probably inhibits pepsin, a proteolytic enzyme.

IDEAL CHARACTERISTICS OF ANTACIDS

- Should not absorbable or cause systemic alkalosis.
- Should not liberate carbon dioxide & cause rebound hyperacidity/ulcer.
- Should not interfere with absorption of food.
- Should not be a laxative or cause constipation.
- Should be quick acting & exert its effect over a longer period of time.
- Should buffer in the pH range 4-6.
- Should probably inhibit pepsin.
- Should be inexpensive.

WHO CANNOT TAKE ANTACIDS

- Sodium bicarbonate is not safe in pregnancy can cause fluid buildup but it is okay to use antacids that have calcium carbonate.
- Sodium bicarbonate also not appropriate for patient with kidney failure/problems or heart disease (high blood pressure/congestive heart failure)

ANTACIDS

Classification of Antacids:

Antacids are classified into two types:

1. Systemic antacids
2. Non-systemic antacids

Systemic (Absorbable)Antacids:

These antacids get systemically absorbed. These are highly soluble and potent neutralizer. These are not suitable for the treatment of peptic ulcer because of risk o ulcer perforation which are occur due to production of CO_2 in stomach ex. Sodium carbonate

Non-systemic antacids (Non- absorbable)Antacids:

These are insoluble and poorly absorbed systemically

Ex. Magnesium and aluminium salt

1) Aluminium containing antacid
2) Calcium containing antacids
3) Magnesium containing antacids
4) Combination antacid preparation

Sodium Bicarbonate

Molecular Formula: $NaHCO_3$

Molecular Weight : *84.01* g/mole

Synonyms: Sodium hydrogen carbonate, backing sodium, meetha soda

Standards: It contains not less than 99% and more than 101% of $NaHCO_3$.

Method of preparation:

1) ***Solvay ammonia process:*** in this process CO2 Passed through a solution of common salt in ammonia water which leads to the precipitation of sodium bicarbonate with ammonium chloride.

Step1: *Formation of ammonium bicarbonate*

$CO_2 + H_2O + NH_3 \longrightarrow NH_4HCO_3$

Step2: *Formation of sodium bicarbonate*

$NaCl + NH_4HCO_3 \longrightarrow NaHCO_3 + NH_4Cl$

2) Laboratory method:

Sodium bicarbonate is prepared from pure sodium carbonate.

$Na_2CO_3 + CO_2 + H_2O \longrightarrow 2NaHCO_3$

Sodium Bicarbonate

Physical Properties:

1. It is a white crystalline powder or granules.
2. It is odourless and has saline taste.
3. It is soluble in water to small extent but insoluble in alcohol.
4. it is stable in dryer and decomposed in moist air
5. It is alkaline to litmus.

Chemical Properties :

1. On heating, its decomposes into sodium carbonate, carbon dioxide and water.

$2NaHCO_3 \longrightarrow Na_2CO_3 + H_2O + CO_2\uparrow$

On reacting with acid and its form salt.

$2NaHCO_3 + H_2SO_4 \longrightarrow Na_2CO_4 + 2H_2O + 2CO_2\uparrow$

- Popular & widely used antacid
- Water solubility – neutralizes gastric acid very quickly
- Rapid onset relatively very short duration of action.
- The pH may be significantly increased upto 7
- ***Disadvantages:*** produces metabolic alkalosis and disturb the acid-base balance of the body fluids (water solubility/absorption of cationic moiety)

The carbon dioxide evolved during the reaction may cause bleaching and flatulence along with carminative action.

SODIUM BICARBONATE (BAKING SODA)

Identification Tests:

1. An aqueous solution of sodium bicarbonate when boiled, liberates carbon dioxide.

$$2\,NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

sodium bicarbonate — sodium carbonate

Dose: It is given in the dose of 4-5g three to four times a day

Formulations: sodium bicarbonate is formulate as an effervescent powder, as tablet and as an injection

Preparation: Sodium hydrogen carbonate is also prepared on large scales by the Solvay process, in which sodium chloride reacts with ammonia, carbon dioxide and water to give $NaHCO_3$ along with ammonium chloride salt (NH_4Cl).

$$NaCl + NH_3 + CO_2 + H_2O \rightarrow NaHCO_3 + NH_4Cl$$

A common side-reaction that occurs during the heating of the Bicarbonate to drive off Ammonium Chloride (NH_4Cl) is the conversion of some of the Bicarbonate to Sodium Carbonate (Na_2CO_3):

$$2\,NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

sodium — sodium

- ***Uses:*** **short term antacid treatment Heartburn Dyspepsia**

SODIUM BICARBONATE (BAKING SODA)

Thus, it required to analyze Sodium bicarbonate product to determine the percentage of sodium bicarbonate & sodium carbonate it contains. Note: Refer Preparation and Standardization of HCl by NaHCO3 or Na2CO3.

- Another main preparation method involves dissolving soda ash (sodium carbonate mineral) in water and passing carbon dioxide through the solution. **$Na_2CO_3 + CO_2 + H_2O \rightarrow 2\ NaHCO_3$**

Method of Analysis:

Volumetric analysis /Titrimetry:

1. Adding hydrochloric acid to sodium bicarbonate solution (Refer Preparation and Standardization of HCl by NaHCO3 or Na2CO3).

Assay:

- ✓ Weigh accurately about 2 g of Sodium Bicarbonate, previously dried (when dried, It contains not less than 99.0% of NaHCO3), dissolve in 25 ml of water, & titrate with 1 M sulfuric acid (indicator: 3 drops of bromophenol blue which changes from blue to yellow).
- ✓ Soon before the titration reaches the endpoint, boil to expel carbon dioxide, cool, and continue the titration.
- ✓ Equivalence Factor: 1 ml of 0.5 mol/l sulfuric acid = 84.01 mg of NaHCO3

SODIUM BICARBONATE (BAKING SODA)

Test for purity: The sample is tested for the presence of following impurities

1. Arsenic should not be more than 2 ppm
2. Sulphate should not be more than 150 ppm and chlorides should not be more than 200 ppm

3. Iron should not be more than 20 ppm
4. Heavy metals should not be more than 5ppm
5. Other impurities to be tested include carbonates and calcium
6. Loss on drying should not be more than 1%

Incompatibility:

it inhibits the absorption of tetracycline from GIT tract

Caution: Cardiovascular patients or those on sodium restricted diet should be advised to avoid this antacid

Assay: its assay is based on **acid – base titration** Weigh 1.5 gm of substance in 50ml of water and titrate with 1N HCL using methyl orange as an indicator

$$2NaHCO_3 + 2HCl \longrightarrow 2NaCl + 2H_2O + 2CO \uparrow$$

Each 1ml of 1N HCl = 0.08401g of $NaHCO_3$

SODIUM BICARBONATE (BAKING SODA)

Storage Conditions: It should be stored in air tight containers because of its hygroscopic nature in moist atmosphere It releases carbon dioxide at50o C and gets converted to sodium carbonate at 100o C

Uses:

1. It is used as an antacid to neutralize excess of gastric hydrochloric acid
2. It is specific for the treatment of systemic acidosis because in stomach it releases carbon dioxide which leads to gastric irritation and flatulence
3. It is used as electrolyte replenisher
4. Its 5% solution is used in ear drops for softening of ear wax
5. Its 3.5% solution in warm water is used in eye lotion
6. It is a major ingredient in compound sodium bicarbonate tablet
7. It is an ingredient in much effervescent antacid preparation . e.g. ENO
8. It is used as leavening agent for the expansion of dough in producing baked products

ALUMINIUM HYDROXIDE GEL

Molecular Formula: $Al(OH)_3$

Molecular Weight : *77.99* g/mole

Standards: Not contain less than 3.5 % and not more than 4.4% w/w Al_2O_3

1) Aluminium hydroxide gel
2) Dried aluminium powder (or aluminium hydroxide or aluminium hydrate powder)

Method of preparation:

Prepared by adding hot solution of potash alum, with contestant stirring with sodium carbonate, after remove of CO_2, ppt aluminium hydroxide filtered and washed with hot water until it free from sulphate ion.

$3Na_2CO_3 + 2KAl(SO_4)_2 + 3H_2O \rightarrow 3Na_2SO_4 + K_2SO_4 + 2Al(OH)_3 + 3CO_2$

Physical properties:

- ✓ Is an ideal buffer in the range 3-5
- ✓ Slightly affect on red and bus paper
- ✓ When heated to red hot, it decomposes into water and aluminium oxide.

$2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$

***Storage Conditions*:** It should be stored at a temperature not exceeding 25 °C.

Identified test: A solution of it in dil. HCl gives the entire test for aluminium.

ALUMINIUM HYDROXIDE GEL

- It is a white viscous aqueous suspension. Using dose 7.5 to 15 ml.
- It has a pH between 5.5 and 8.0
- Sodium benzoate as preservative & oil of mentha as flavouring agent are sometimes added to the gel.
- **Chemically:** mixture of Al hydroxide, Al oxide hydrate, & small amount 3.5% - 4% of Al carbonate/basic carbonate.
- Amphoteric and dissolves readily in acids & in alkalis forming aluminium salts & aluminates respectively.
- Aluminium hydroxide gel gives aluminium chloride when it reacts with gastric HCl.
- This results into nausea, vomiting & constipation

$Al(OH)3 + 3HCl \rightarrow AlCl3 + 3H2O$

Method of Analysis:

- 5g sample is dissolved in 3 ml of HCl by waming. Cool & dilute to 20ml with water.
- To this solution add 40 ml of 0.5 M disodium EDTA, 80ml water & few drops of methyl red indicator.
- The solution is then neutralised using 1N NaOH dropwise.
- Then titrate the neutralised solution against 0.05 M lead nitrate using xylenol orange as an indicator.

- Each ml of EDTA is equivalent to 0.002549 g of AlOH gel (AL2O3)

ALUMINIUM HYDROXIDE GEL

Test for purity: The sample is tested for the presence of following impurities:

1. Arsenic should not be more than 1 ppm
2. Sulphate should not be more than 0.3% and chlorides should not be more than 0.25%
3. Iron should not be more than 20 ppm
4. Heavy metals should not be more than 10 ppm

Dose: 200 mg , 2-4 tablets in a day.

Formulation: Formulated as chewable tablet and a suspension.

Uses:

1) Aluminium oxide gel is used externally as mild astringent and desiccant
2) It is used in the treatment of diarrhoea and cholera and act as protective
3) It is a constituent in some foot powder.
4) It is a also used as an antacid .

Dose: It is given in the dose of 200mg, 2-4 tablets in a day.

Formulation: It is formulated as chewable tablet and as suspension

- E.g., Aluminium hydroxide gel (mixture of Al hydroxide, Al oxide hydrate, Al carbonate), other e.g., diydroxy aluminium aminoacetate, dihydroxy aluminium sodium carbonate and Al phosphate.
- Shows both neutralizing activity & protective activity on the mucosal surface of the stomach and duodenum.
- Used in the form of colloidal viscous suspension and are found to have steady & prolonged action.
- Antacid activity is due to the liberation of Al+ cations.

Compounds of aluminium also shows:

- adsorbent activity for various gases & toxins.
- buffering effect on gastric pH
- Inhibit pepsin activity
- Side effects: peristalsis (wormlike movement) & tend to induce constipation ! But this problems can be overcome by their combination with magnesium salts. e.g., Al(OH)3 with Mg(OH)2.
- In pharmacopoeia, popularly used aluminium hydroxide gel is described under suspension & dried forms.
- Stability: A loss of antacid property of the gels during the aging process is reported in I.P. Hence, the gel preparations are needed to be stabilized.

MILK OF MAGNESIA

- Chemically it is magnesium hydroxide ($Mg(OH)_2$)
- Also called as magnesium hydroxide mixture or cream of magnesia
- It is a bulky white powder insoluble in water and alcohol.
- It is soluble in dilute acids like dil HCl
- It neutralizes gastric acid by giving away Mg cations and Hydroxide ions
- $Mg(OH)_2 \rightarrow Mg^{2+} + 2OH^- \rightarrow 2H_3O^+ \rightarrow 4H_2O$
- Usually given in combination with AlOH or Ca antacids

Method of Analysis:

5 sample is taken after thorough shaking and 25 ml of 1N H_2SO_4 is added and excess of acid is back titrated with 1 N NaOH using methyl red indicator.

- Factor: 0.02917 g
- Uses: antacid and laxative
- Dose: As an antacid 300 to 600 mg As a laxative 2 to 4 g

Magnesium Hydroxide Gel

It's a 8% w/w oral suspension of hydrate magnesium oxide. It may be prepared from a suitable grade of light magnesium oxide.

Ingredients of mixture:

Magnesium sulphate	47.5 g
Sodium hydroxide	15 g
light magnesium oxide	52.5 g
chloroform	2.5 ml
Purified water	q.s
Sufficient to produce	1000ml

Physiological properties:

It is a white uniform suspension which does not separate easily on standing.

Identification test:

1) Alkaline to moist litmus paper.
2) Dil. Nitric acid gives all the test of magnesium.

Assay:

Based on acid- base titration.

Uses:

Mainly used as antacid to neutralize stomach acid as well as laxative in occasional constipation.

Oral suspension relief heart burn and indigestion problem.

Prescribed in case of stomach ulcer or stomach cancer.

Combination of antacids

Combined preparation:

1) Compound magnesium trisilicate oral powder
2) Magaldrate
3) Algicon tablet
4) Simeco tablet
5) Aluminium hydroxide gel magnesium trisilicate combination

✓ This combined

ANTIMICROBIALS

- Topical anti-infective agents may be applied to intact cutaneous & mucous surface before surgery & to treat minor cuts, abrasions or burns.
- Koch (1865) had established the relationship between infection and micro-organism till then the need for topical anti-infective agents was not realized.
- Hospital disinfection, sterilization of instruments and the surgical hand wash are the general measures which are being routinely used to reduce the risk of hospital acquired infections and to minimize the transfer of micro-organisms to the susceptible patients.

Topical anti-infective agents may be categorized into:

1. Keratolytic agents: Agents used to apply on the skin to soften the keratin e.g. Sulphur & Aluminium oxide
2. Antiseptic agents
3. Disinfectants
4. Sanitizers
5. Germicides

- Antimicrobials/topical anti-infective agents is an agent which kill microorganisms or stop their growth.
- Antibacterial agents can be further subdivided into bactericidal agents, which kill bacteria, and bacteriostatic agents, which slow down or stall bacterial growth

- Antiseptic is any agent which either kills or inhibits the growth of microorganisms when applied topically at damaged tissue.
- Disinfectant agents destroy microorganisms but not usually bacteria spores.
- Germicides agents kill microorganisms. it may be classified as bacteriocides (bacteriostatic – inhibit the growth of bacteria), sporicides, viricides and fungicides.
- Sterilization is total removal or destruction of all living microorganisms which is done by chemical or mechanical processes like heat or radiation (e.g. UV radiation) methods.

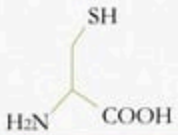
Mechanism of Action of Antimicrobials

- Most of the topical anti-infective agents exert antimicrobial activity through either:

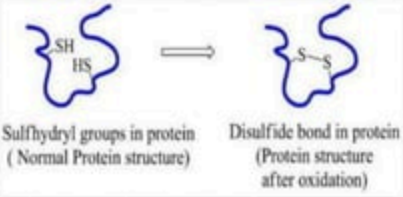
1. Oxidation
2. Halogenation
3. Protein precipitation

1) Oxidation:

- Oxidation liberating compounds (oxidizing agents) give action by this mechanism.
- Antimicrobial agents causes oxidation of active functional groups present in protein or enzymes and inactivate them.
- Eg.: Sulfhydryl functional group of cysteine (amino acid) is important for many protein and enzymes of microbes.

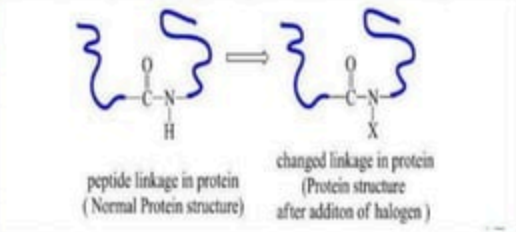


Antimicrobial agents converts this Sulfhydryl group to disulfide bond. Hence inactivate the protein as restricted the conformational changes needed to work.



2) Halogenation:

- The halide and hypohalide liberating compounds give action by this mechanism.
- Agents add halide atom to nitrogen present at peptide linkage of the protein and there by change the conformation of protein



peptide linkage in protein
(Normal Protein structure)

changed linkage in protein
(Protein structure
after additon of halogen)

3) Precipatation of proteins:

- Metal containing compounds give action by this mechanism.
- Metal binds with important group present in protein. This protein- metal complexation (chelation of protein) inactivates the protein.

Normal Protein structure

Protein-metal
compexation

Category by Mechanism:

Oxidation mechanism

(1) Hydrogen Peroxide

(2) Potassium permanganate

(3) Sodium perborate

Halogenation mechanism

(1)Iodine and its various official Preparation.

(2)Povidone –iodine solution

(3)Potassium iodide

(4) Calcium oxychloride

Precipitation of proteins

(1)Boric acid

(2) Borax

(3)Silvernitrate

(4)Mercury oxide

(5)Antimony sodium tartate

(6)Ammoniated mercury

Hydrogen Peroxide

Physical properties Chemical properties

(1) In pure state hydrogen peroxide is almost colourless (very pale blue) liquid, acidic in taste.

(2) It melts at 272.4 K and has a boiling point of 423 K.

(3) It is miscible in water in all proportions and forms hydrates.

Chemical properties

(1) It is rapidly decomposed on coming in contact with oxidiable organic matter and with certain metals and also if allowed to become alkaline.

(2) It decomposes into water and oxygen

$H2O2 \rightarrow H2O + O$

Chemical properties:

- -It slowly decompose at ordinary temp. and readily at higher temp.

$2H_2O_2 \longrightarrow 2\,H_2O + O_2$

- Hydrogen peroxide reacts as either oxidizing or reducing agent depending upon chemical environment
- E. g. of oxidation reaction
- a.H2o2 oxidises potassium iodide to iodine in acidic medium

$2KI + H_2O_2 + H_2SO_4 \longrightarrow I_2 + K_2SO_4 + 2H_2O$

Hydrogen Peroxide

b. H_2O_2 oxidises lead sulphide to lead sulphate

$$PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$$

c. H_2O_2 oxidises ferrous to ferric ion

$$2FeSO_4 + H_2O_2 + H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 2H_2O$$

Ferrous Sulphate → Ferric Sulphate

- E.g. of reduction reaction

a. H_2O_2 reduces silver oxide to metallic silver

$$Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2\uparrow$$

b. H_2O_2 reduces potassium permanganate to colorless form.

$$2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \longrightarrow 2MnSO_4 + K_2SO_4 + 8H_2O + 5O_2\uparrow$$

Violate color → Colorless

c. H_2O_2 reduces halides

$$I_2 + H_2O_2 \longrightarrow 2HI + O_2$$

Hydrogen Peroxide

Preparation:

1. From sodium peroxide (Merck's method) Calculated amount of sodium peroxide (Na_2O_2) is gradually added to an ice-cold solution of 20% H_2SO_4 in small lots with constant stirring.

   $Na_2O_2 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O_2$

2. Upon cooling, crystals of $Na_2SO_4.10H_2O$ separate out and the resulting solution contains about 30% H_2O_2 .
3. The solution also contains some dissolved Na_2SO_4 , but it does not interfere with the reactions of H_2O_2
4. A pure sample of H_2O_2 may, however, be prepared by vacuum distillation

FROM BARIUM PEROXIDE: treatment of thin aqueous cream of barium peroxide with cold dilute sulphuric acid forms hydrogen peroxide

$BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$

When CO_2 is passed slowly through ice cold paste of barium peroxide, hydrogen peroxide is formed

$BaO_2 + CO_2 + H_2O \rightarrow BaCO_3 + H_2O_2$

Hydrogen Peroxide

Assay: oxidation-reduction titration:

• hydrogen peroxide is titrated with a standard solution of potassium permanganate in the presence of sulphuric acid at room temperature. potassium itself act as indicator. the end point is appeared as a permanent pink colour

$KMnO4 + H2SO4 + 5H2O \rightarrow K2SO4 + MnSO4 + 8H2O + O2$

Uses:

• hydrogen peroxide used as disinfectant, anti infective and deodorant.

• Hydrogen peroxide ear drops have been used for the removal of wax.

• Hydrogen peroxide solution is used as a mouth wash in treatment of acute stomatitis and as deodorant gargle

Potassium Permanganate KMnO4

- The salt is also known as "permanganate of potash.
- The permanganate ion is a strong oxidizing agent. It dissolves in water to give deep purple solutions, evaporation of which gives prismatic purplish-black glistening crystals.
- It has a sweet flavour with sweet astingent taste.

Uses:

- Act as disinfectant, deodorant
- Act as astringent, anti-infective and bactericidal agent
- Solutions are used to clean ulcers or abscesses as wet dressings and in baths in eczematous condition.

POTASSIUM PERMANGANATE

$KMnO_4$

Physical properties:

- dark purple crystals, odourless, sweet astringent taste
- Soluble in water

Chemical properties:

- Decompose at higher temp.

$$2\,KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2\uparrow$$

E.g. of oxidation reaction

a. $KMnO_4$ oxidises potassium iodide to iodine in acidic medium

$$10\,KI + 2\,KMnO_4 + 8\,H_2SO_4 \longrightarrow 5I_2 + 2MnSO_4 + 6\,K_2SO_4 + 8\,H_2O$$

Potassium Permanganate KMnO4

Preparation:

- Potassium permanganate is prepared by heating potassium hydroxide with manganese dioxide in the presence of air or an oxidizing agent such as potassium nitrate or potassium chlorate

$2KOH + MnO2 \longrightarrow K2MnO4 + H2O$

- The greenish product potassium manganate is extracted with water and treated with carbon dioxide. Or ozonized air to precipitate about one third of the manganese as the hydrated dioxide
- The remaining manganese in converted into

KMno4 $3K2MnO4 + 2CO2 \longrightarrow 2KMnO4 + MnO2 + 2K2CO3$

If chlorine is passed through the solution in place or carbon dioxide the whole of the manganese of the manganate is converted into permanganate

$2K2MnO4 + Cl2 \longrightarrow 2KMnO4 + 2KCL$

- Manganate can also be converted into the permanganate by electrolyzing a warm solution

$2KMnO4 + 2H2O \longrightarrow 2KMnO4 + 2KOH + H2$

Potassium Permanganate KMnO4

Preparation

Potassium permanganate is manufactured on a large scale due to its manifold uses in the laboratory. In the first stage, pyrolusite, which is manganese dioxide in its natural form, is fused withpotassium hydroxide and heated in air or with potassium nitrate (a source of oxygen). This leads to the formation of potassium manganate, which on electrolytic oxidation in alkaline solution gives potassium permanganate.

$$MnO_2 + 2OH^- + O_2 \rightarrow MnO_4^{2-} + H_2O$$

$$MnO_4^{2-} + Cl_2 \rightarrow MnO_4^- + 2Cl^-$$

Permanganates can also be prepared by treating a solution of Mn^{2+} ions with very strong oxidising agents like lead dioxide, PbO_2, or sodium bismuthate, $NaBiO_3$, and these reactions have been used to test for the presence of manganese due to the formation of the distinctly violet colour of permanganate.

Uses

Almost all applications of potassium permanganate are derived from it being an oxidizing agent in diverse chemical reactions in the laboratory and in industry.

Assay of Potassium Permanganate:

- The assay is based on the oxidation reduction titration which is carried out with a standard solution of oxalic acid in the presence of sulphuric acid at 70oC throughout the entire titration. In the assay potassium permanganate itself serves as an indicator to give pink colour.

$$2KMNO4 + 5\ H2C2O4.2H2O + 5H2SO4 \rightarrow K2SO4 + 2MnSO4 + 18H2O + 10CO2$$

Each ml of 0.1N oxalic acid is equivalent to 0.00316 g of KMnO4

Boric Acid (H_3BO_3)

- It occurs as an odourless, white crystals or white powder with slight acidic and bitter taste.
- Solubility: Freely soluble in glycerin & partially soluble in water & alcohol.
- various dehydration products obtained by heating boric acid with a loss of water include :

Temperature ◦C	Dehydration product
100	Metaboric acid (HBO_2)
160	Tetraboric acid ($H_2B_4O_7$)
More than 160	Boron trioxide ($2B_2O_3$)

Preparation:

1. Boric acid can be prepared by adding a mixture of conc.H_2SO_4 and water to a boiling solution of borax

$Na_2B_4O_7 + H_2SO_4 + 5H_2O \rightarrow Na_2SO_4 + 4H_3BO_3$

2. Preparation of boric acid involves the reaction between borax (disodium tetra borate decahydrate) with a mineral acid such as hydrochloric acid (HCl).

The obtained white crystals of boric acid are completely insoluble in cold water.

$Na_2B_4O_7.10H_2O + 2\ HCl \rightarrow 4\ B(OH)_3$ (or H_3BO_3) + $2\ NaCl + 5\ H_2O$

Boric Acid (H_3BO_3)

Assay:

- ✓ It is assayed by titrimetric method. Being a very weak acid, it can not be directly titrated accurately with strong alkali.
- ✓ When it is dissolved in a mixture of water and glycerin, it behaves like a strong monobasic acid (i.e. glyceroboric acid)
- ✓ and then it can titrated with alkali using phenolphthalein as an indicator till pink colour.
- ✓ Factor: each ml of 1.0N NaOH is equivalent to 0.06183 g of H_3BO_3.

- ***Uses:***
- it is used as a local anti-ineffective agent, germicide & dusting powder as an antiseptic.
- It is also used in ophthalmic preparations as buffer.
- Boric acid can be very dangerous, "not for internal use".

Iodine & its Preparations

I_2

Physical properties:

- Grey black colour, brittle, irritant odour
- Volatile at room temp.
- Very slightly soluble in water but highly soluble in conc. iodide soln.

Chemical properties:

- Melts at 114°C and dissociates at 700°C, gives vapors

$$I_2 \xrightarrow{\text{dissociation}} 2\,I$$

E.g. of oxidation reaction

$$Fe + I_2 \longrightarrow FeI_2$$

Iron — Ferrous iodate

$$H_2S + I_2 \longrightarrow 2\,HI + S_{(s)}$$

Hydrogen sulphide

Preparation:

- From sea weed's ash

- Sea water contains iodine as salts forms.
- These salts are absorbed by seaweeds (e.g. *Lominaria digitata*)
- These sea weeds are dried, burnt and ash is collected which is called as **Kelp.**
- Aqueous solution of kept is prepared and concentrated (where the sulphates and chlorides of sodium and potassium crystallize out).
- Crystals are removed by filtration. The solution contains only salts of iodides of sodium and potassium.
- the solution is treated with sulphuric acid and then with manganese dioxide and heated.
- Synthesized iodine is purified and collected

$$2NaI + 3H_2SO_4 + MnO_2 \longrightarrow MnSO_4 + 2\,NaHSO_4 + I_2 + 2H_2O$$

Iodine & its Preparations

Assay:

- Principle: direct iodimetric type redox titration
- Iodine is added in aq. solution of KI + 2 M acetic acid
- Titrant: 0.1 N sodium thiosulphate
- Indicator : starch

$$2\,Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2\,NaI$$

- Factor: Each ml 0.1 M $Na_2S_2O_4 \cong 0.01263$ g of iodine

Potassium iodide is added in aqueous iodine solution.

- Iodine is a non-polar molecule, it does not ionize in water.

$$H\text{-}OH \longrightarrow \overset{\oplus}{H}\ \overset{\ominus}{OH}$$

$$I\text{–}I \longrightarrow \text{No ionization}$$

- KI is a polar, ionic compound, will ionize and dissolve in water.

$$K\text{–}I \longrightarrow \overset{\oplus}{K}\ \ \overset{\ominus}{I}$$

- The iodide salt will react with I_2 to form the complex ion I_3^-
- I_3^- being negatively charged will **dissolve in water.**

$$\overset{\ominus}{I} + I\text{–}I \longrightarrow \overset{\ominus}{I_3}$$

- *KI is used to dissolve the iodine in water.*

Use:

- Antiseptic – act by formation of hypoiodous acid (HIO).
- Iodine is supplied externally (e.g. iodized salt) for proper functioning of thyroid gland.
- Used for the preparation various iodine solution or official preparations

various official preparations of Iodine

1. Aq. iodine soln (Lugol' s solution)
2. Weak iodine solution (tincture of iodine)
3. Strong iodine solution

Storage:

- In a glass stoppered bottle or well closed ceramic containers

various official preparations of Iodine

Aq. Iodine soln (Lugol' s solution)

Weak iodine solution (tincture of iodine)

Strong Iodine solution

M/A = Antiseptic action by Halogenation mechanism

Iodine & its Preparations

AQUEOUS IODINE SOLUTION

- Aqueous iodine soln contains 5% w/w of Iodine, I_2 and 10% w/w of KI in water

Ingredients:

Iodine..... 50g
Potassium Iodide..... 100g
Purified water..... q.s.1000ml

Physical properties:

- transparent, brown liquid with smell of iodine

Preparation:

- KI and iodine are dissolved in 100ml of water and volume is made up to 1000ml

Assay:

- Assay carried out both for iodine and KI content in preparation.

Use:

- As a germicide and fungicide agent. It does not cause irritation to cuts like tincture of iodine.
- As a source of iodine

Iodine & its Preparations

WEAK IODINE SOLUTION

Synonym: Iodine tincture

- Weak iodine soln contains 2% w/w of Iodine, I_2 and 2.5% w/w of KI in 50% alcohol

Ingredients:

Iodine..... 20g
Potassium Iodide..... 25g
Alcohol (50%)..... q.s.1000ml

Physical properties:

- transparent, brown liquid with smell of iodine and alcohol

Preparation:

- KI and iodine are dissolved in sufficient quantity of alcohol and volume is made up to 1000ml with alcohol

Assay:

- Assay carried out both for iodine and KI content in preparation.

Use:

- Is a popular antiseptic agent

Iodine & its Preparations

STRONG IODINE SOLUTION

- Strong iodine soln contains 10% w/w of Iodine, I_2 and 6% w/w of KI in alcohol-water mixture

Ingredients:

Iodine..... 100g
Potassium Iodide..... 60g
Purified water.....100g
Alcohol (90%)..... q.s.1000ml

Physical properties:

- transparent, brown liquid with smell of iodine and alcohol

STRONG IODINE SOLUTION

Preparation:

- KI and iodine are dissolved in 100ml of water and volume is made up to 1000ml with alcohol

Assay:

- Assay carried out both for iodine and KI content in preparation.

Use:

- Antiseptic agent

Iodine & its Preparations

POVIDONE-IODINE SOLUTION

- It is aq. solution of povidone-iodine complex which contains up to 10% w/v of free iodine.
- Povidone = polyvinyl pyrrolidine

Physical properties:

- povidone-iodine is yellowish brown amorphous powder
- Soluble in water and alcohol, aq. solution is acidic.

Providone iodine is better than tincture of iodine

- More water soluble, non-irritant, non staining nature, it can easily removed from skin and clothes by washing.

POVIDONE-IODINE SOLUTION

Use:

- Antiseptic – skin, throat infection or wounds, burns and cuts.
- Solution is diluted up to 1%, thus free iodine content is increases and increase in the antiseptic action

Storage:

- Well closed iodine resistant container.

Calcium Oxychloride

CALCIUM OXYCHLORIDE

$Ca(OCl)Cl$

Synonym:

Bleaching powder , Calcium chloro hypochloride, Chlorinated lime

Physical properties:

- dry, dull white powder, hygroscopic in nature

Chemical properties:

a. Decomposed in air.

$$2\,Ca(OCl)Cl + CO_2 + H_2O \longrightarrow CaCO_3 + CaCl_2 + 2HOCl$$

b. Decomposed on prolonged storage

$$2\,Ca(OCl)Cl \longrightarrow Ca(ClO_3)_2 + 5CaCl_2$$

c. Decomposed by dil. acid

$$Ca(OCl)Cl + 2\,HCl \longrightarrow CaCl_2 + H_2O + Cl_2$$

Preparation:

- Passing current of chlorine gas over calcium hydroxide (slaked lime) in lead container.

$$Ca(OH)_2 + Cl_2 \longrightarrow Ca(OCl)Cl + H_2O$$

Assay:

- Principle: Direct iodometric redox type titration
- To the aq. soln of sample, add KI
- Then add acetic acid
- mixture is kept aside in dark for 10 minutes.
- Titrate against Sod. thiosulphate
- Indicator: starch

$$2\,Ca(OCl)Cl + 2\,CH_3COOH \longrightarrow (CH_3COO)_2Ca + HOCl + HCl$$

$$H\ \ + H \longrightarrow H_2 + {}_2$$

$$2KI + Cl_2 \longrightarrow 2KCl + I_2$$

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

Use:

- as Antiseptic – wounds
- as Disinfectant – sterile rooms, drains
- for Chlorination of water (treatment of swimming pools)
- as Bleaching agent

Storage:

- Well-closed container, in cool place

CATHARTICS
DRUGS FOR CONSTIPATION

Cathartics Examples:

- Magnesium sulphate
- Sodium orthophosphate
- Kaolin and
- Bentonite

Constipation: To infrequent passage of stool that may be due to decreased motility in colon or due to difficulty in evacuation. Causes: Diet: Decrease in water & fiber contents of diet. Local painful conditions like piles Lack of muscular exercise Drugs: Muscle relaxants, Anticholinergics, Calcium channel blockers etc

Treatment of Constipation General:

- Adequate fluid intake
- High fiber contents in diet
- Regular exercise
- Regulation of bowel habit (nature call)

• Avoid drugs causing constipation Drugs:

- Laxatives
- Purgatives
- Cathartics

CATHARTICS
DRUGS FOR CONSTIPATION
Types/Classification

1. ***Bulk purgative or bulk forming laxative:***

- Act by increasing the nonabsorbabale solid residue.
- made from cellulose, sodium carboxyl methyl cellulose and karaya gum.

2. Stimulant purgative:

- act by local irritation on the intestinal tract which increase peristaltic activity, motility & secretion.
- E.g. phenolphthalein, aloin, cascara extract, rhubarb extract, senna extract, podophyllin, castor oil, bisacodyl, calomel etc.

3. Stool/Fecal Softeners or emollient laxatives or lubricants:

- act by altering the consistency of feces/stool or by facilitating the passage of compacted stool/fecal material - easier to pass
- Promote more water & fat in the stools
- E.g. Liquid paraffin, mineral oil, d-octyl sodium sulfosuccinate, an anionic surface active agent (detergents).

CATHARTICS
DRUGS FOR CONSTIPATION
Types/Classification

4. Osmotic purgative or saline cathartics or saline purgative:

• Saline cathartics act by increasing the osmotic load of the GIT (retain water osmotically).

• They are salts of poorly absorbable anions $H_2PO_4^-$ (biphosphate), HPO_4^{2-} (phosphate), sulphates, tartarates, and soluble magnesium salt.

• Saline cathartics are water soluble and are taken with large quantities of water.

• They act in the intestine and a full cathartic dose produces a water evacuation within 3-6 hrs

.• Because of their quick onset of action they are given early in the morning before breakfast. • They are used for bowel evacuation before radiological, endoscopic and surgical procedures and also to expel parasite and toxic materials. • Small amounts of these drugs may be absorbed in the blood causing occasional toxicity. • The absorption of magnesium may cause marked CNS depression while that of sodium worsens the existing congestive cardiac failure (CCF)

Magnesium sulphate

I.P. limit: It contains not less than 99.0% and not more than 100.5% of magnesium sulphate.

Properties: It forms colorless prismatic crystals. It dissolves in water, is practically insoluble in alcohol. It has cooling saline bitter taste.

Preparation:

1) It can be prepared by neutralizing hot dilute sulphuric acid with magnesium or its oxides or carbonate. The solution is filtered; the filtrate is concentrated and recrystallized.

Magnesium sulphate

•***Prepared from magnesium oxide:***

This is obtained by the thermal decomposition of:

magnesium hydroxide (obtained from sea water):

$Mg(OH)2(s) \rightarrow MgO(s) + H2O(g)$

• Magnesium carbonate (from the ore magnesite):

$MgCO3(s) \rightarrow MgO(s) + CO2(g)$

• In either case, the oxide is reacted with sulfuric acid to produce magnesium sulphate:

$MgO(s) + H2SO4(aq) \rightarrow MgSO4(aq)$

Assay:

Weigh accurately about 6.3gm of sample dissolve in 50ml of water, add 10ml of strong ammonia ammonium chloride solution and titrate with 0.05M disodium EDTA using 0.1gm of moderate black II mixture as indicator until blue color is obtained.

• Each ml of 0.05M disodium EDTA≡ 0.00602 gm of $MgSO4$

Uses:

It is used as osmotic laxative, in treatment of electrolyte deficiency, in wet dressing in boils, in treatment of sea sickness, hypertension etc.

Magnesium sulphate

Test for Identification:

- For magnesium: To solution of sample add dilute nitric acid solution a white precipitate is produced that is redissolved by adding 1ml of 2M ammonium chloride, add 0.25M disodium hydrogen phosphate a white crystalline precipitate is produced.
- For sulphate: To 5ml of sample solution add 1ml of dilute HCl and 1ml barium chloride solution white precipitate. Add 1ml of iodine solution to the suspension, the suspension remains yellow (distinction from sulphites and dithionites) but decolorizes on adding stannous chloride (distinction from iodates).

Sodium orthophosphate

• ***Properties:***

NaH3O4P + white odorless crystals, granules or a crystalline powder, available in hydrated forms. Soluble in water

• ***Identification Test:***

Sodium: to a solution of sample add 1 ml of acetic acid and 1 ml of uranyl zinc acetate. A yellow crystalline precipitate is formed within a few min. • Phosphate: to 5 ml of solution add 1 ml of conc. nitric acid and 5 ml of ammonium moly date and warm. A bright canary yellow precipitate is obtained

• Orthophosphate: acidify small amt of sample with dil. Acetic acid and add 1 ml of silver nitrate. A yellow precipitate is formed

Sodium orthophosphate

- ***Assay:***

Weigh accurately 4gm of substance and dissolve in 25ml of water add 25ml 1N HCl and titrate potentiometrically with 1M NaOH to first inflection point of the pH curve (n1) continue titration until second infection of curve is reached. The total volume of NaOH required is n2 ml. calculate percent content from the expression

- 1420(25-n1)/w (100-d) d is percentage of water content.

Uses:

- Widely used as saline cathartic.
- It is a pharmaceutical aid used as buffering agent.

Kaolin

- Kaolin is categorized as light kaolin, light kaolin (natural), heavy kaolin (china clay).
- Light kaolin is used internally as adsorbent, it is a native hydrated aluminium silicate.
- It contains a suitable dispersing agent. Properties: white, odourless, tasteless powder ointment like (soft) to touch.
- It is insoluble in water, mineral acids & alkali hydroxides solutions.

Uses: Adsorbent for toxic substances form the GIT As dusting powders, toilet powders and as filtering aid.

Bentonite

- Bentonite is widely known for its high swelling characteristics occurs as a very fine buff or cream coloured powder.
- It is odourless, free from grit and has slightly an earthy taste.
- A typical bentonite is almost insoluble in water and has the ability to absorb 4-5 times its own weight in water and can swell 5 - 15 times its dry volume at full-unconfined saturation.
- It neither dissolves nor swells in organic solvents.
- ***Chemical composition:*** $Al_2O_3.4(SiO_2).H_2O$ i.e., aluminium phyllosilicate clay

Uses: As a bulk laxative, desiccant, base for many dermatologic formulas, emulsifier for oil in water emulsion, granular bentonite is being studied for use in wound dressings and bentonites are used for decolorizing various mineral, vegetable and animal oils.

- They are also used for clarifying wine, liquor, cider, beer and vinegar and also as a lubricant to cool the cutting tools.
- Types/available forms: Sodium bentonite, Calcium bentonite and Potassium bentonite
- The Free Swell test procedure is used to determine the general swelling characteristics of bentonite.