CHAPTER - 4.

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Gastrointestinal Agents:

A Acidifying Agents

The condition of the absence of hydrochloric acid in the gastric secreations may be due to free of gastric hydrochloric acid after stimulation with histamine phosphate or due to lack of gastric hydrochloric acid though there may be stimulation by histamine.

The first condition is found in persons with a gastectomy, a trophic gastritis, carcinoma of stomach or gastric polyps.

The second condition is caused by chronic nephritis and alcoholism, tuburculosis, hyperthyroidism, pellagra (Nutritional disorder), diarrhoea, parasitic infections.

eg. Dilute HCl.

Dilute HCl is 9.5 to 10.5 percent w/v of HCl prepared by mixing HCl acid (274 gm) with water (726 gm). It is stored below 30°C in air tight container of glass.

When diluted HCl is further diluted with 25 to 50 volumes of water, it may be used as gastric acidifier to treat Achlorohydria.

Antacids.

Systemic (absorbable)	Non-systemic (Non-absorbable)
Example: → $NaHCO_3$ → Sodium Bicarbonate	Example: → Aluminium Hydroxide → Magnesium oxide → Calcium carbonate → Sodium Carboxymethyl cellulose

Ideal Antacid Features:

i) Should be quick acting.

ii) Should not causes rebound acidity.

iii) Should not produce systemic alkalisis.

iv) Should not interface with adsorption of food

v) Should be palatable and inexpensive.

Aluminium Hydroxide Gel ($Al(OH)_3$, Mol. Wt → 78) is an aqueous suspension of hydrated aluminium oxide with different amount of basic aluminium carbonate and bicarbonate.

It contains about 3.5% to 4.4% Al_2O_3
It may contain glycerine, sorbitol, sucrose or saccharin as sweetening agent, pippermint oil as flavour.
It may also contain suitable antimicrobial agent and preservative.

Preparation:

$$AlCl_3 + 3NH_4OH \rightarrow Al(OH)_3 + 3NH_4Cl$$

Physical Characters:

Aluminium hydroxide is a white, light, odourless, tasteless, amorphous powder containing some aggregates. It is soluble in dilute mineral acids and in solutions of alkali hydroxides.

Chemical Properties

In presence of alkali, it behaves as an acid.

$$Al(OH)_3 \rightleftharpoons 3H^+ + AlO_3^{3-}$$

In acidic medium, it acts as a weak base.

$$Al(OH)_3 \rightleftharpoons Al^{3+} + 3OH^-$$

Chemical Properties.

$$Al(OH)_3 + 3NaOH \rightarrow \underset{\text{Sodium aluminate}}{Na_3AlO_3} + 3H_2O.$$

Test for purity

Tests for arsenic, ammonium salts; chloride; lead; sulphate;

Test for Identification

Test	Observation	Inference
Dissolve the sample in dilute HCl + Add drops blue litmus + Ammonium hydroxide ~~added~~ added till the solution is alkaline	Blue coloured precipitate floated on the surface	Al^{3+} Confirmed.

Uses.

1. Aluminium hydroxide is a gastric antacid.
2. It is used as a phosphate binder in patient with chronic renal failure.
3. As an adjurant in the manufacturing of absorbed vaccines.
4. It is also used in antiperspirants and dentifrices.

Aluminium Phosphate ($AlPO_4$)

→ Mainly exist in the form of hydrated aluminium orthophosphate, containing not less than 80% of $AlPO_4$.

→ Mineral ore : angelite, wavelite, lucinite.

$NaAlO_2$ + H_3PO_4 → $AlPO_4$ + H_2O + $NaOH$

Aluminium sodium oxide — Phosphoric acid

Physical Character

It is white infusible powder containing some friable aggregates, M.P. 1460°C, it is practically insoluble water and very ~~soluble~~ slightly soluble in conc^{d} HCl and nitric acid. Aluminium phosphate gel is white, viscous suspension from which small amount of water may separate on standing it may contain suitable preservatives.

The gel has a pH in the range 6.02 to 7.2.

Test for Purity

Test for arsenic, heavy metals, fluoride, sulphate, soluble phosphate neutralizing capacity.

Test for identification

A solution in 2N HCl gives a reaction of aluminium salt.

A solution in 2N Nitric acid gives a reactions of phosphate.

Assay:

The assay is based on complexometric titration.

It is assayed in terms of Aluminium phosphate content.

0.8 g of sample + Acid + Disodium acetate + Ammonia + Ammonium acetate (7.7 g)

→ PH adjusted to 4.5 with glacial acetic acid.

→ Dithizone in ethanol is added.

→ Titrated with 0.5 N zinc chloride until the colour change to Red.

Each ml of 0.05M disodium edatate is equivalent to 6.098 mg of $AlPO_4$.

Uses.

Used as an adjuvant in manufacture of adsorbed vaccines.

It is used in place of aluminium hydroxide gel where loss of phosphate may be problem to the patient.

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Calcium Carbonate :
(Precipitated Chalk)

* $CaCO_3$. Mol. wt - 100.0

* Natural Sources :- limestone, marble, calcite, iceland spar, domomite, shells of sea animal.

Preparation :-

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

$$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$$

insoluble soluble.

Physical Properties:

i) $CaCO_3$ occurs as a white odourless, tasteless, microcrystalline powder which is stable in air.

ii) It is dimorphous, orthorhombic
eg:- Aragonite M.P: 825°C.

iii) It is practically insoluble in water and alcohol, and soluble with acetic acid, Hydrochloric acid, Nitric acid.

Chemical Properties:

$$CaCO_3 \xrightarrow{> 83} CaO + CO_2$$

$$CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$$

insoluble — calcium bicarbonate soluble.

Test for purity:

Test for Al, Arsenic, iron, lead, barium, magnesium and alkali metal, phosphate, sulphate, chloride and heavy metal.

Test for identification:

When calcium carbonate is added to acidic acid effervescence is produces and the resulting solution after boling give the rxn of calcium.

Incompatibility :

Acids, Alum, Ammonium salt.

Assay :

0.1 gm of calcium carbonate + 3ml of dil HCl + 10 ml water.

↓ Boiled for 10 min and cooled.

Further diluted to 50 ml with water.

↓

Titrated with 0.05 M disodium ethylenediamine tetraacetate and NaOH solution and calcon mixture are added to get the end point.

↓

Titration is continue until the colour change pink to blue.

↓

Each ml of 0.05 M disodium ethylenediamine tetraacetate is eq. to 0.0050 of $CaCO_3$.

Uses :-

i) $CaCO_3$ is used as antacids.

ii) Calcium supplement in homeopathic medicine.

iii) Use in dentifrices, insecticides, cosmetics antibiotic, antidiarrheal agent.

18/04/2022

Magnesium Carbonate.

Molecular formula : $(MgCO_3)_4 . Mg(OH)_2 . 5H_2O$.

Approx Mol. Weight → 485

i) Natural Source :- Magnesite, Lansfordite.

ii) Preparation :

$$MgCl_2 + 2NaHCO_3 + CO_2 + H_2O \rightarrow MgCO_3\downarrow + 2NaCl + 2H_2CO_3$$

Heavy Magnesium Carbonate :- $(MgCO_3)_3 . Mg(OH)_2 . 4H_2O$

Light Magnesium Carbonate : $(MgCO_3)_3 . Mg(OH)_2 . 3H_2O$

90-95% MgO.

iii) Physical property :-

Both are White odourless powder or light, white, friable masses. They are stable in air practically insoluble in water and alcohol but dissolve in dilute acids.

iv) Chemical Properties :

$$MgCO_3 \xrightarrow{700^\circ C} MgO + CO_2.$$

$$4MgCO_3 \cdot Mg(OH)_2 \cdot 5H_2O \rightarrow 5MgO + 4CO_2 + 6H_2O.$$

v) Test for purity :

Test for arsenic, Calcium, Chloride, copper, iron, lead, sulphate, heavy metal, soluble matter, substance insoluble in acetic acid.

vi) Test for Identification :

A solution in dilute nitric acid gives the reaction of magnesium and of carbonates.

(vii) Assay of Magnesium Carbonate :

0.18g of sample + dil. HCl (2ml) + 50 ml water + Strong Ammonium chloride solution (10ml)

↓ titrated with

0.05M disodium EDTA

↓

Using 0.1g of mordant black 11 mixture as indicator

↓

Pink colour is discharged from the blue.

Uses:

→ Used as antacid.

→ Used as cathartic and laxative.

→ Used as food additive.

→ Tooth powder and face powder.

23/04/22

☆ Magnesium Oxide (Magnesia)

MgO :- Mol. Wt :- 40.3

Magnesium oxide contains not less than 98.0% of MgO.

Natural Source:

Mineral Periclase.

Preparation:

$$MgCO_3 \xrightarrow{\Delta \text{ slightly}} MgO + CO_2$$

$$3MgCO_3 \cdot Mg(OH) \cdot 3H_2O \xrightarrow[\Delta]{\text{Red Heat}} 4MgO + 3CO_2\uparrow + 4H_2O.$$

Physical Character:

Light magnesium oxide is very light, bulky, white powder whereas heavy magnesium oxide is dense mass.

Both oxides are odourless, slightly alkaline taste.

Practically insoluble in water.

They absorb moisture and CO_2 when exposed to air.

Chemical Properties:

$$MgO + H_3O^+ \longrightarrow Mg(OH)_2 + 2H_2O.$$

$$MgO + 2HCl \longrightarrow MgCl_2 + H_2O$$

Magnesium chloride (salt)

$$CaC_2 + MgO \rightarrow MgC + CaO + C$$

Magnesium carbide.

Test for purity

Test for arsenic lead, copper, iron chloride, sulphate, heavy metals.

Test for identification.

→ A solution in dilute HNO_3 gives the reaction of magnesium.

Assay :

Assay is based on ~~complexation~~ complexometric titration.

0.1 g. sample + 2 ml HCl.

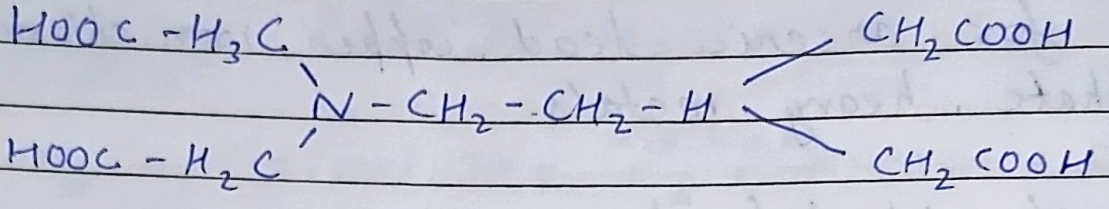
↓ Strong NH_4Cl solution added.

Then titrate with 0.05M disodium EDTA using 0.1 g of ~~moderate~~ mordant black 11 mixture as indicator.

↓

At End point colour changes pink to blue.
Each ml of 0.05 M disodium EDTA is equivalent to 0.002015 g of MgO.

Ethylene tetraacetic acid (EDTA)



Uses :-

1. As osmotic laxative.
2. Food additive
3. In hypomagnesemia.
4. As antacid in gastric ulcer.
5. Compounding and preserving fluid extract due to its absorptive properties.
6. In dentrifices.

25/09/22

☆ Magnesium Trisilicate.

$2MgO.3SiO_2.3H_2O$.

Mol. wt :- 260.86.

It contains about 29 to 32% of MgO and 68.5% of SiO_2

Preparation

① Prepared by adding HCl to a solution of sodium silicate followed by addition of precipitated magnesium hydroxide.

② $2MgSO_4 + 2Na_2O.3SiO_2 \rightarrow 2MgO.3SiO_2.3H_2O + Na_2SO_4 + H_2O$.

Physical Properties.

It is an colourless, fine, white, tasteless powder.

It is practically insoluble in water and alcohol.

Chemical Properties.

$2MgO.3SiO_2 + 4HCl \rightarrow MgCl + H_4Si_3O_8\downarrow$

Trisilicic acid

Test for purity:

Test for Arsenic, chloride, Lead, Sulphate, Heavy metals.

Test for identification

0.5g of sample boil with 10 ml NaOH solution.

↓ filtered

Acidified with dil. HCl and boiled.

↓

The residue is washed on the filter paper

↓

Dissolved in HCl and filtered.

↓

Filterate ~~gas~~ gives the reaction of ~~mg~~ magnesium

Uses:

1. As an antacid.
2. Used as an adsorbent.
3. It relieves pain in gastric ~~acid~~ and duodenal ulcers and possibly absorbs the pepsin.

✱ Antacid Combination.

1. Aluminium hydroxide magnesium carbonate co-dried gel. Dose upto 1 gm.

2. **Algicon tablet:**

Aluminium hydroxide magnesium co-dried gel (360 mg), magnesium alginate (500 mg) magnesium carbonate (320 mg) and potassium bicarbonate (100 mg).

3. **Simeco tablet:**

Contains aluminium hydroxide-magnesium carbonate co-dried gel (282 mg), magnesium hydroxide (85 mg) and activated dimethicone (25 mg).

4. **Megaldrate:**

Chemical composition of Aluminium hydroxide magnesium hydroxide.

It contains the equivalent of 28 to 39% magnesium hydroxide and 17 to 25% aluminium hydroxides.

✱ Protective and adsorbent

✱ Bismuth Subcarbonate $[(BiO_2)CO_3]_2 \cdot H_2O$.

→ Bismuth subcarbonate contains not less than 82.5% of Bi and 79% of Bi_2O_3. It is a basic salt of variable composition

Preparation

$$2Bi + 8HNO_3 \longrightarrow 2Bi(NO_3)_3 + 2NO + 4H_2O$$

Metallic Bismuth

$$Bi(NO_3)_2 \xrightarrow[Na_2CO_3]{H_2O} (BiO)_2CO_3$$

Physical properties.

It is a white, heavy, odourless, micro-crystalline, tasteless, slightly hygroscopic powder.

Practically insoluble in water and alcohol, readily soluble in Nitric acid.

Test for purity:

Test for chloride nitrate, alkali and alkaline earth metal, arsenic, copper, silver, lead.

extramarks

Chemical Property

$[(BiO_2)_2 CO_3]_2 \cdot H_2O$

$\xrightarrow{\Delta}$ Red Heat

Bi_2O_3 + Nitrogen oxides
NO_2, N_2O.

Test for identification

It gives the reaction characteristic of bismuth compounds and of carbonates

Assay:

0.5g sample dissolved in HNO_3

↓ diluted with H_2O (250ml)

Carried out the complexometric titration of bismuth with disodium - EDTA.

Each ml of 0.1N disodium EDTA is equivalent to 20.90 mg of Bi.

Uses:-
(i) As anta cid
(ii) Mild astringent
(iii) Dusting powder
(iv) Antiseptic
(v) Protective and adsorbent.

☆ Kaolin $(Al_2O_3 . 2SiO_2 . 2H_2O)$

China clay.

Natural Source:

Decomposition of feldspar of granitic rocks. Kaolin consists of mainly aluminium silicate with traces of compounds of magnesium, calcium, iron.

Preparation:

Kaolin is prepared when the rock is mined, excavated and the impurities are washed with water and then powdered.

Physical properties:

Kaolin is slightly plastic-like and is normally white. It has an earthy or clay-like taste. Its colour may be tinged gray, yellow, brown, blue or red due to impurities. Its fusion points in between 1700-1800. On heating it losses water.

Heavy Kaolin:

→ It's particle are 20 μm in diameter, flat and irregularly arranged.

→ White or greyish-white. Practically insoluble in water.

Light Kaolin.

→ Particle size 2 µm in diameter.

→ Light kaolin is a white light, odourless, unctous powder, free from gritty particles.

→ It is practically insoluble in water and mineral acids.

Test for purity.

Test for arsenic, carbonates, chloride, heavy metal, sulphate, calcium, iron, loss on dry, organic impurities, absorption power, swelling power, particle size, alkalinity and acidity.

Uses :-

i) Used as adsorbent.
ii) Antidiarrhoeal.
iii) Used as ~~dysent~~ dusting powder and food additive.
iv) Heavy kaolin is used in the preparation of kaolin poultice.
v) Used as detoxifying agent.

✱ Saline Catharatics (Purgatines)

- Fasten and increase evacuation of bowels.
- Used for patient having problem in defecation.
- Used in painful haemorrhoids (piles)
- In acute constipation.
- To remove solid materials from the intestinal tract prior to certain x-rays studies.

→ Laxative are mild cathartics that are used for short term therapy.

→ Laxative may be used for evacuation which are of four types.

① Stimulant laxative.
ii) Bulk forming laxative
iii) Emollient laxative
iv) Saline laxative.

✱ Laxative (Mild Cathartics)

i) Stimulant :

Phenolphthalein, aloin, extract of cascara, castor oil, sennahubarb etc.

ii) Bulk forming:

Psyllium seed, methyl cellulose, sodium carboxymethyl cellulose and karaya gum etc.

iii) Emollient :

Mineral oil and d-octyl sodium sulphosuccinate.

iv) Saline.

a) Cationic → Magnesium salts.

b) Anionic → $H_2PO_4^-$, HPO_4^-, sulphate, tartrate.

✱ Magnesium Sulphate.

$MgSO_4 . 7H_2O$, Mol. wt = 246.47.

Natural Source:

Kieserite, epsomite.

Preparation :

(i) $MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

(ii) $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$.

(iii) $MgCO_3 \cdot CaCO_3 + H_2SO_4 \rightarrow MgSO_4 + CaSO_4 + 2CO_2 + 2H_2O$.
Dolomite

✱ Physical character of $MgSO_4$.

→ Odourless, colourless crystals or white crystalline powder, bitter, saline and cooling taste. It is soluble in water (1 in 1.5) and very soluble in warm water Practically insoluble in water when exposed to moist air. It is stored in a well closed container.

Test for purity :

Test for arsenic, iron, lead, zinc, chloride, heavy metals loss on drying (≤ 1.1 %).

Test for identification :

A solution (1 in 20) gives the reaction of Mg and sulphate.

Assay:

Assay is based on the complexometric titration carried out with EDTA.

- 0.3g of sample + 50 ml of water..

↓

Add 10 ml of stoong Ammonium chloride solution

The reaction mixture is titrated with 0.05 M disodium EDTA using 0.1 of mordant black 11 mixture as indicator, until the pink colour is discharged from the blue.

Each ml of 0.05M EDTA ≡ 0.00602g of $MgSO_4$.

Uses:

(i) As a saline laxative.
(ii) Treatment of ~~Mg~~ Magnesium deficiency.
(iii) As anticonvulsant.
(iv) Local anti-inflamatory agent in infected wounds.

☆ Sodium Potassium Tartrate:

$COONa.CH(OH).CH(OH).COOK.4H_2O$.

or $NaKC_4H_4O_6.4H_2O$.

Mol. wt - 282.17.

→ It contains 99 to 104% of $NaKC_4H_4O_6.4H_2O$

Preparation:

i) $2KHC_4H_4O_6 + Na_2CO_3 \xrightarrow{60^\circ C} 2KNaC_4H_4O_6 + CO_2 + H_2O$.

Potassium bitartrate — Sodium Carbonate

Physical Properties:-

Odourless, Colourless, crystals or White crystaline powder with a cooling saline taste.

Cooling saline taste.

M.P. → 70 - 80°C

Soluble in water (1:1), Insoluble in alcohol Aquous solution is slightly alkaline to litmus. pH 7-8. It is stored in air tight container.

✱ Chemical Properties:

i) It gives characteristic reaction of sodium potassium and tartrates.

ii) CH_3COOH (5%) + $2KNaC_4H_4O_6.4H_2O \rightarrow 2KHC_4H_4O_6$

~~$2KHC_4H_4O_6$~~

Potassium tirate (white ppt.)

✱ Test for purity:

Test for arsenic, chloride, iron, heavy metals, sulphate, loss on drying.

✱ Assay:

A weighed ammount (2g) is heated until Carbonized cooled.

↓

Residue boiled with 50ml of water and 0.5 N H_2SO_4.

↓ filtered ~~with~~ washed with water.

Then titrated with 0.5 N NaOH solution using methyl orange solution as indicator.

↓

Each ml of 0.5 N $H_2SO_4 \cong 0.07056$ g of $NaKC_4H_4O_6.4H_2O$.

★ Uses:-

i) Used as laxative.

ii) Stabiliser in cheese and meat product.

iii) It is used in seidlitz powder and Fehling's solution.