Pharmacedu.in

Gastrointestinal Agents

Unit III

Acidifier

→ These are the inorganic substance that either produced or increase acid.

→ These chemicals increase the level of gastric acid in the stomach thereby decrease the stomach pH.

→ It is broadly classified into four classes :—

(i) Gastric Acidifier.

(ii) Urinary Acidifier.

(iii) Systemic Acidifier.

(iv) Acid.

(i) Gastric Acidifier

These are drugs which are used in increase the acidity of stomach.

→ These agents used in patient suffering from achlorhydria or hypochlorhydria. (absense or insufficient quantity of HCl in the stomach).

→ The achlorhydria patient are of two types —

(i) Those who donot respond to histamine phosphate stimulation for the release of HCl.

(ii) Those who respond to histamine phosphate stimulation for the release of HCl in stomach.

→ In either of the cases, the GI disturbances, eg.- frequent bowel movements or mild diarrhoea, epigastric pain (upper middle portion of the abdomen) and sensitivity to spicy food are the common symptoms.

→ Obviously, the best agent to treat achlorhydria is Dilute Hydrochloric Acid.

(ii) Urinary acidifier

→ These are the drugs which are used to remove acidic urine from the body or to maintain the pH of urine.

→ These acidifier are widely used to cure some type of urinary track infection.

(iii) Systemic acidifier

→ These are the drugs which are able to neutralized the alkalaine body fluid (blood) or maintain the pH of all parts of body.

→ It is used to treat patient suffering from systemic alkalosis.

(iv) **Acid**: These are used as pharmaceutical aids in the preparation of medicament.

Hydrochloric Acid [HCl] M.W = 36.46

Synonym = Spirit of salt.

Preparation

It can be prepared by action of conc. H_2SO_4 on sodium chloride and passing the liberated hydrogen chloride through water.

$$NaCl + H_2SO_4 \longrightarrow HCl + NaHSO_4$$

Properties

→ It is nearly colourless, clear and fuming liquid.

→ It has pungent odour

→ It is soluble with water and alcohol.

→ It is strong acid.

Storage: It should be stored in well closed containers of glass or other inert material at a temp not exceeding 30°C.

Use:

→ Used as acidifier.

→ Used as pharmaceutical aids.

→ Used to activate the proteolytic enzyme (pepsin).

Antacids

→ Antacids are substances which on ingestion react with the gastric acid and lower the acidity of gastric contents.

→ They produce a symptomatic relief of heart burn, pain by neutralizing the excess of HCl.

→ Antacids are weak bases and they raise the gastric pH above 4 by neutralizing excess gastric HCl, which may be causing pain and possible ulceration.

→ One may also use antacids to inactivate proteolytic enzyme. (pepsin).

→ Most of the antacids are relatively free from serious side effects except sodium bicarbonate, which in addition raise pH above 7, may also cause systemic alkalosis in addition to other effects.

Types of Antacids

(i) Systemic antacids (absorbable)

→ These are soluble, readily absorbable and capable of producing systemic electrolytic alterations and alkalosis.

eg- sodium bicarbonate.

(ii) Non systemic (non-absorbable) antacids

→ These are not absorbed to a significant extent and thus donot exert an appreciable systemic effect.

eg- Aluminium salts, magnesium salts, calcium carbonate

Ideal characteristics of Antacids

(i) It should not be absorbable or cause systemic alkalosis.

(ii) It should not liberate CO_2 & cause rebound hyperacidity.

(iii) It should not interfere with absorption of food.

(iv) It should not be a laxative & cause constipation.

(v) It should be quick acting and exert its effect over a long period of time.

(vi) It should buffer in the pH 4-6 range.

(vii) Should be palatable & inexpensive.

Combination of Antacids

Systemic antacids are not used regularly as they causes alkalosis & edema and congestive heart failure because of sodium ion in excess.

Non-systemic antacids are more content and effective as compared to systemic antacids. They are insoluble and poorly absorbed systematically but they have sometime unfavourable side effects.

So, each solo compound among antacids have some or other side effects when used for longer duration.
To decrease the adverse effect (side effects) associated with antacids, the combination of antacids are used.

Example

① Magnesium & Aluminium containing preparation.
Aluminium hydroxide which is a slow acting antacids with fast acting antacids magnesium hydroxide.

② Calcium and Magnesium containing preparation Here, one having laxative effects and other have constipation.

③ Antacids combine with simethicone or alginate type compounds which have antiflatulent or protective action as they are protective and cause dispersion of gases or create protective reflux barrier.

Sodium Bicarbonate ($NaHCO_3$) M.W = 84.01

Synonym - Sodium hydrogen carbonate
Common name - Baking soda, Nitha soda.

Preparation

It is prepared by passing CO_2 gas through a solution of sodium hydroxide.

$$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$$

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

Properties

(i) It occurs as white crystalline or amorphous powder.
(ii) It is having saline test
(iii) The solution is alkaline in nature.
(iv) It freely soluble with water but practically insoluble in alcohol.

Use

(i) It is mainly used as an electrolyte replenisher.

(ii) It is mainly used for its acid neutralizing properties.

(iii) It is also find used as an antacid.

(iv) It is used as local applicants for burns, insects bite etc.

Aluminium Hydroxide Gel $[Al(OH)_3]$ M.W = 77.99

Synonym – Aluminium hydroxide mixture.

Preparation

When a aluminium salt such as aluminium chloride is treated with ammonium or Sodium carbonate, a white gelatinous precipitate of aluminium hydroxide is obtained.

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

$$Al(OH)_3 + 3NaOH \longrightarrow Na_3AlO_3 + 3H_2O$$

Cathartics [Laxative]

These are the drugs which are used to bring about defecation (emptying of stomach).

They are used to :—

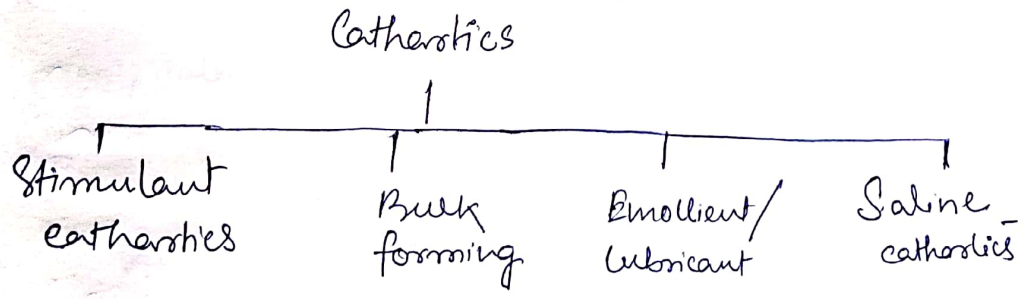
(i) To relieve about acute constipation.

(ii) To ease in defection of patient suffering from rectal disorder.

(iii) To clear bowel (intestine or stomach movement) from stomach before surgery.

→ Laxative is used for mild cathartic whereas purgatives is used for strong cathartics.

→ Cathartics are generally act by four different mechanism.



① Stimulant : Are the drugs which acts by local irritation on intestinal track by increasing peristalsis activity or movement.

eg- Castrol, Senna etc.

② Bulk forming : which promote evacuation by increasing the stools bulk- volume and water contents. eg- Isapgol, methyl cellulose.

③ Emollient/Lubricant : which penetrate, lubricate and soften the stool.
eg- mineral oil, glycerine.

④ Saline Cathartics : Are the drugs which act by increasing the osmotic load of GIT and they are capable of absorbing large quantity of water. eg- $MgSO_4$, Sodium Orthophosphate etc.

Magnesium Sulphate $(MgSO_4.7H_2O$ [M.W = 246.50]

Synonym = Epsom salt
It contains not less than 99% and not more than 100% of $MgSO_4$.

Preparation : It is obtained by action of dil. H_2SO_4 on $MgCO_3$ or MgO.

$$H_2SO_4 + MgSO_3 \longrightarrow MgSO_4 + H_2O + CO_2$$

$$H_2SO_4 + MgO \longrightarrow MgSO_4 + H_2O$$

Properties

(i) It is odourless, colourless or white crystalline powder.

(ii) It is having a bitter saline and cooling taste.

(iii) Soluble in water but sparingly soluble in alcohol.

Uses

(i) Used as cathartics.

(ii) Used in treatment of electrolyte deficiency.

(iii) Used as an anticonvulsant.

Storage: Stored in lightly closed container.

(2) Kaolin ($Al_2O_3\,2SiO_2 \cdot 2H_2O$) [M.W = 258]

Synonyms: China clay or hydrated aluminium silicate.

Classification

(i) Soft – Breaks easily with soapy texture.

(ii) Hard – Difficult to break with jagged texture.

(iii) Flint – Helps no commercial value because of its high silica content.

Preparation

→ Widely distributed in nature.

→ Pharmaceutically useful kaolin is purified by treatment with HCl or H_2SO_4 or both, then wash with water.

Properties

→ Its colour is white sometimes red, blue, brown because of impurities.

→ Odour and taste is earthy.

→ It has soft texture free from gritty particles.

Use

(i) Used in treatment of diarrhoea.

(ii) Used as dusting powder.

(iii) Used as tablet diluent [for bulk formation]

(iv) Light kaolin is used as food additive.

Storage

Stored in tightly closed container.

③ Sodium Orthophosphate ($Na_2HPO_4 \cdot 12H_2O$) M.W = 358.14

Synonym – Disodium hydrogen phosphate.

It contains not less than 98.5% and not more than 101%.

Preparation

It is prepared by reaction of phosphoric acid with sodium hydroxide.

$$2NaOH + H_3PO_4 \longrightarrow Na_2HPO_4 + 2H_2O$$

Properties

(i) It is odourless, colourless, crystalline powder.

(ii) It has saline acidic taste.

(iii) It is freely soluble in water and practically insoluble in alcohol.

Storage

Stored in tightly closed container.

Use

(i) It is used as saline cathartics.

(ii) Used as buffer in pharmaceutical preparations.

(iii) Used as an anti-caking additives in powder powders.

④ Bentonite

Synonym – soap clay

→ It is native (colloidal) hydrated aluminium silicate 90% montmorillonite and rest is feldspar.

→ Aluminium silicate montmorillonite ($Al_2Si_4O_{12}H_2$), feldspar ($K_2OH_2O_3 6SiO_2$)

Preparation

→ Bentonite is excerted from solid even with moisture content of about 30%.

→ The obtained material is initially crush and activated with addition of soda (sodium carbonate) as bentonite.

→ The so formed is then dried seemed milled by removing the minerals.

→ It is purified and treated with acid to produce acid activated bentonite or treated with organic to produce organic clay.

Properties

→ It is white pale buff or cream colour fine powder.

→ Odourless, insoluble in water.

→ Also insoluble in inorganic solvents.

Use

→ It is commonly use for intestinal detoxification and cleansing.

→ Used for treatment for both constipation and diarrhoea.

→ It can attract & absorb toxins & impurity.

→ Used as pharmaceutical aid & suspending agents.

→ Used as antidotes having heavy metal poisoning.

Storage

Stored in highly closed container.

ANTIMICROBIALS

→ Antimicrobials are the chemical agents used to destroy or inhibit the growth of pathogenic micro-organisms. such as bacteria, fungi or protozoa.

→ They are normally ineffective on the sporing state of micro-organisms.

→ They include antiseptic, disinfectants, bacteriostatic, germicidal, sanitizer, sterilization.

Classification

(i) Antiseptic : It is a substance that prevents the growth of action of micro organism. It applied on skin.
eg- Phenol, Iodine etc.

(ii) Disinfectants : These are the drugs or substance used either to kill bacteria or prevent their growth. It is used on non-living objects.
eg- Disinfection of surgical instrument, sputum etc.

(iii) Germicides: These are the substance or agents which kill microorganism. They act by oxidation of bacterial protoplasm, by denaturation of bacterial enzymes & proteins.
eg- Fungicide (against fungi), Virucide (against virus) etc.

(iv) Bacteriostatic: These are the substances which primarily function by inhibiting the growth of bacteria.

(v) Sanitizers: It is the process of rendering sanitary by reducing the number of bacterial contaminants.
eg-

(vi) Sterilization: It is the complete destruction of all living micro-organisms.
It can be achieved by physical methods (application of heat or radiation) or by chemical means (use of chemical disinfectants)

Mechanism of action

→ Ideally, an antibacterial is expected to affect only microbes sparing the host cells and many organic compounds .. eg - antibiotics.

→ However, the action of inorganic antibacterials is mostly non-specific.

→ These agents affect all proteins in similar manner and in higher concentrations affect host protein as well as microbial protein.

→ They act mainly by oxidation or halogenation or protein precipitation and alter the molecular shape (confirmation) of the proteins or important enzyme surfaces.

→ Which leads to the hindrance in regular biochemical mechanisms and finally lead to the destruction of the protein.

Oxidation

→ Reducing groups present in the most proteins get oxidised by oxidising agents.

→ e.g - 2 Sulphydryl group, –SH form a disulphide bridge, –S–S–,).

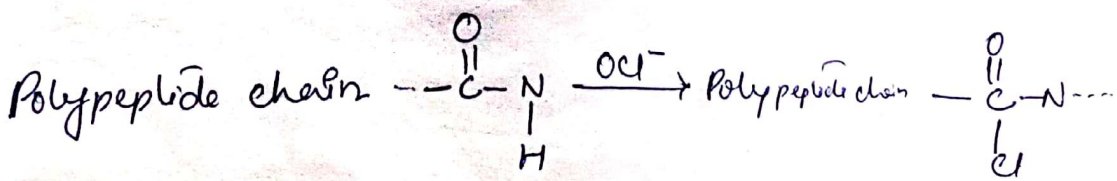
→ Thus, alter the molecular shape of the protein, ultimately leading to the destruction of the protein.

→ Generally, non-metals, certain anion, hydrogen peroxide act by this mechanism.

Halogenation

→ Primary and Secondary amide groups present in protein at peptide linkage undergo chlorination with change in molecular shape and ultimately destruction of the protein.

→ Hypohalites, especially hypochlorite, OCl^- act by this mechanism.



Protein precipitation

The compound (metal ion) interact with protein (ligand). The complex form leads to inactivation of protein.

eg- Boric acid, borax.

① Potassium permanganate ($KMnO_4$) M.W = 158.03

Preparation

It can be prepared from potassium manganate which is oxidize by chloride or under acid condition.

$$2K_2MnO_4 + Cl_2 \longrightarrow 2KMnO_4 + 2KCl$$

$$3K_2MnO_4 + 4HCl \longrightarrow 2KMnO_4 + MnO_2 + 2H_2O + 4KCl$$

Properties

→ It occured as dark purple colour.

→ It is odourless with sweetish astringents alkaline taste.

→ It is soluble in water.

Uses

① Used for treatment of various skin condition like superficial wound, topical ulcer.

② Used as antiseptic in mouthwashes.

③ Used as antidote in the case of barbiturate and alkaloid poisoning.

Storage: stored in tightly closed container.

② Boric Acid (H_3BO_3) M.W = 61.83

Synonym — Hydrogen borate

→ It is having not less than 99.5% of boric acid

Preparations

→ It is prepared by reacting Borax with mineral acid (H_2SO_4 & HCl).

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

Properties

→ It is white crystalline solid.

→ Odourless, having sweet taste.

→ Soluble in water and alcohol.
Freely soluble in glycerine.

Uses

→ Used as antiseptic for minor cuts or burns.

→ Also used as bacteriostatic, insecticides & astringents.

→ Also useful in primary buffer solution.

Storage: Stored in tightly closed container and kept at cool place.

② Hydrogen peroxide [H_2O_2] M.W = 34

Synonym – Perhydroxide acid.

It is an aq. solution of H_2O_2

Preparation

H_2O_2 is formed by the reaction of sodium peroxide with cold dil. sulphuric acid.

$$Na_2O_2 + H_2SO_4 \longrightarrow H_2O_2 + Na_2SO_4$$

Properties

→ It is clear colourless liquid.

→ Odourless having bitter acidic taste.

→ It is miscible with water.

Assay: H_2O_2 is assayed by oxidation-reduction titration.

10 ml of H_2SO_4
+ (diluted)
10 ml dist. water

↓

Add 10 ml of 5N H_2SO_4

↓

Titrate with 0.1N $KMnO_4$

↓

Faint pink colour is obtained

→ Each ml of 0.N $KMnO_4$ = 0.001701 g of H_2O_2

Uses

→ Used as antiseptic, germicidal & disinfectants.

→ Used for bleaching the hair.

→ Also used for tooth whitening.

→ It is used ~~for~~ as an antidote in phosphorous and cyanide poisoning.

Storage

Stored in light resistance container in cool & dark place.

④ Chlorinated lime (Bleaching powder) $[Ca(OCl)_2]$

M.W = 142.98

Synonym = Bleaching powder

It is having not less than 30% w/w of chlorine.

Preparation

It is prepared by treating slaked lime with chlorine gas at about 25°C.

$$2Cl_2 + 2Ca(OH)_2 \longrightarrow \quad + CaCl_2 + 2H_2O$$

(Slaked lime)

Storage

Stored in tightly closed container in dry & cold place away from organic material and matter.

Properties

→ It is white or grey powder.

→ It has strong characteristics odour of chlorine.

→ It is partially soluble in water & alcohol.

Uses

(i) It has bactericidal action.

(ii) It is used to disinfect faeces, urine and other organic materials.

(iii) It is used as a cleansing agent for toilets, drains and effluents.

(iv) It is a powerful bleaching agent and is used to decolorise most dyes.

Assay : It is assayed by redox titration method.

4gm of chlorinated lime
+ (treated with)
Small quantity of water (H_2O)
↓
100 ml of this suspension is taken in another flask
↓
Titrated with excess of KI soln
↓
Acidified with 5ml of acetic acid.
↓
Liberated iodine is titrated with 0.1N sodium thiosulphide using starch as indicator.

⇒ Each ml of 0.1N sodium thiosulphate = 0.003545g of available chlorine.

⑤ Iodine (I_2) M.W = 253.8

It is having not less than 99.5% of I_2

Preparation

In laboratory, iodine can be prepared by heating potassium iodide or sodium iodide with dil. H_2SO_4 or with MnO_2 (Manganese dioxide)

$$2KI + MnO_2 + 3H_2SO_4 \longrightarrow I_2 + 2KHSO_4 + MnSO_4 + 2H_2O$$

Properties

→ It occurs as greyish-violet or bluish-black.

→ It is having irritant/peculiar odour & bitterly pungent taste.

→ Volatile in nature.

→ It is insoluble in water, soluble in alcohol.

Uses → Used as disinfectants.

→ Used in iodine deficiency.

→ Its 2% solution in glycerol is used for application to mucous membrane.

→ Iodine ointments are applied as counter-irritants.

Storage Stored in highly closed amber colour bottle in cool place.

Preparation of Iodine solution

(i) Aqueous : Also known as Lugol's solution. Doesnot contain any alcohol. It contains 5.0% w/v of Iodine and 10% w/v of potassium Iodide.

prepn 50g I_2 + 100g KI

Dissolve in distilled water in 100 ml water with stirring or shaking.

(ii) Weak : Also known as iodine tincture. It contains 2% I_2 & 2.5% KI.

prepn (20g + 25g) – Dissolve in sufficient quantity of alcohol & volume make upto 100 ml.

(iii) Strong :

→ 10% I_2 & 6% KI

Prepatn (100mg + 60g) → Dissolved in alcohol.

(iv) Tincture of I_2

→ 2% I_2 & 2.4% KI → In much diluted alcoholic solution.

(v) Povidone

It contains not less than 9% and more than 12% of I_2

Prepatn It is complex of I_2 with polymer povidone.