

INORGANIC PHARMACEUTICALS

❖ INORGANIC PHARMACEUTICALS

Study of pharmaceutical applications of inorganic compounds lead to the establishment of a new avenue called ***Pharmaceutical inorganic chemistry***, which deals with the study of elements about their **preparation, standards of purity, test for identification, limit tests** to be performed for determining the quality and extent of purity, storage, different formulations and their storage conditions and therapeutic uses.

3.1 INORGANIC OFFICIAL COMPOUNDS

OF IRON/HAEMATINICS Haematinics -

These are substances required in the formation of blood, and are used for treatment of anaemias. The main haematinics are Iron, Vitamine B_{12} , and Folic acid.



♦Important role of Iron

- The body contains about 3-6 g of iron which is the active centre of molecules responsible for ***oxygen transport*** and ***electron transport***.
- Iron is distributed in blood and other tissues and usually, it occurs in the bound form to haemoglobin, plasma, myoglobin, cell hemes for various functions like; transport of oxygen, iron, for cell respiration and detoxification.

List of official iron Compounds	List of official Preparations
<ul style="list-style-type: none">• Ferric ammonium citrate/Iron and ammonium citrate• Ferrous fumarate• Ferrous gluconate• Ferrous sulfate	<ul style="list-style-type: none">• Ferrous fumarate tablets• Ferrous sulphate tablets• Iron-Dextran injection• Ferrous gluconate tablets

Compounds of Haematinics

HAEMATINIC DRUGS

Ferrous sulphate
 $(FeSO_4 \cdot 7H_2O)$

Ferrous fumarate
 $(C_4H_2FeO_4)$

Ferric ammonium citrate
 $(NH_4)_5[Fe(C_6H_4O_7)_2]$

Ferrous ascorbate
 $C_{12}H_{14}FeO_{12}$

Carbonyl iron
 $Fe(CO)_5$

3.1.1 FERROUS SULPHATE

- ❖ **Synonyms:** Iron vitriol, Ferrosi Sulfas, Green vitriol.
- ❖ **Chemical Formula:** $FeSO_4 \cdot 7H_2O$
- ❖ **Molecular Weight:** 278 g/mol.
- ❖ **Preparation:** When iron is treated with dilute H_2SO_4 , iron dissolve and form ferrous sulphate and hydrogen gas is liberated



❖ Physical Properties

- It occurs as odourless bluish-green crystalline powder.
- Its taste is metallic and astringent.
- It effloresces in dry air.
- On exposure to moisture, it gets oxidised and becomes brown in colour.
- It is completely soluble in water and insoluble in alcohol.

❖ Chemical Properties

- Ferrous sulfate reacts with potassium permanganate in the presence of Sulphuric acid forms ferric sulfate, manganese sulfate, potassium sulfate, and water.



On heating, it decomposes to ferric oxide, sulphur dioxide and sulphur trioxide.



- It reduces the salt of silver and gold to their corresponding metals.
- It forms double salt with sulphates of alkali metals, represented as R_2SO_4 , $FeSO_4$ $FeSO_4 \cdot 6H_2O$. With ammonium sulphate, it gives ferrous ammonium sulphate, $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ (Mohr's salt).

❖ Pharmaceutical Formulations

- Ferrous sulphate tablets- each tablet contain ferrous sulphate 200mg equivalent to 65 mg ferrous ion.
- Ferrous sulphate oral solution- contain ferrous sulfate 125mg equivalent to 25 mg ferrous ion.

❖ Market preparations

- Fesate tablet
- Ferron
- Hemovit



❖ Storage Condition

- It must be stored in air tight containers as it gets oxidised in moist air and forms brown colour layer.

❖ Uses

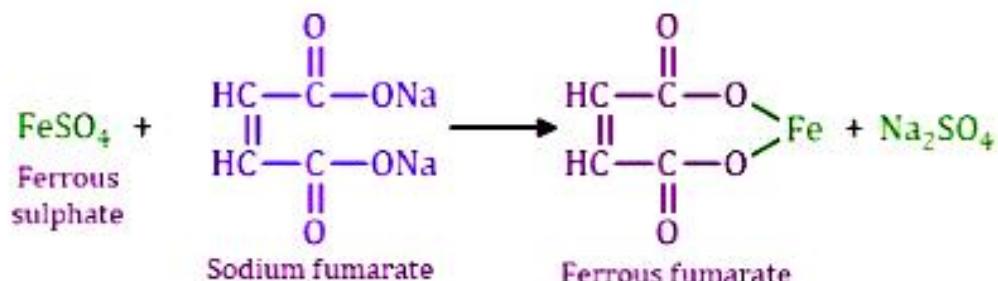
- It is used as haematinic i.e. promote the formation of haemoglobin.
- It is used in the treatment of anaemia caused by iron deficiency.
- It is used to dye fabrics and in tanning clothes.
- It is used in the manufacturing of ink and in photography.
- It also possesses disinfectant property.
- It is used as an insecticide in agriculture.

3.1.2 FERROUS FUMARATE

- ❖ **Synonyms:** Iron(II) fumarate, Feostat
- ❖ **Chemical Formula:** $C_4H_2FeO_4$
- ❖ **Molecular Weight:** 169.9013 g/mol
- ❖ **Preparation**



- Ferrous fumarate can be obtained by mixing ferrous sulphate and sodium fumarate in hot aqueous solution whereupon sparingly soluble anhydrous ferrous fumarate precipitates out.



❖ Physical Properties

- It is a fine reddish-orange to reddish-brown powder.
 - It is a tasteless or slightly astringent.
 - It is an odourless or with a slight odour.
 - It is a slightly soluble in water, very slightly soluble in alcohol.

❖ Chemical Properties

- Ferrous fumarate a new salt of iron which is quite stable to oxidation and hydration.
 - In hot, humid atmosphere this salt remains stable as compared to ferrous sulfate and ferrous gluconate.

❖ Pharmaceutical Formulations

- Ferrous fumarate syrup, B.P
 - Ferrous fumarate and folic acid tablet (Combination)

❖ Market Preparations

- Fersamal
 - Galfer
 - CYPRESS
 - ECOFER



Storage conditions

- It should be stored in clean dry and well closed container.
- It should be kept in cool place.

• Uses

- Used to treat iron deficiency anemia.
- Used to treat pernicious anemia.

3.1.3 FERRIC AMMONIUM CITRATE

- ❖ **Synonyms:** Ammonium iron(III) citrate, Ammonium ferric citrate Iron, ammonium citrate, FerriSeltz.
- ❖ **Chemical Formula:** $C_6H_4O_7 \cdot xFe^{3+} \cdot xNH_3$ or $(NH_4)_5[Fe(C_6H_4O_7)_2] \cdot 2H_2O$
- ❖ **Molecular Weight:** 265 g/mol

❖ Physical Properties

- Ferric ammonium citrate is a yellowish brown to crimson solid.
- It's water soluble.
- It creates bitter smoke and unpleasant smells when heated.



❖ Preparation

- The interaction of ferric hydroxide with citric acid is followed by treatment with ammonium hydroxide, evaporation, and drying to produce ferric ammonium citrate (iron (III) ammonium citrate).
- Depending on the stoichiometry of the starting reactants, the final product takes one of two forms.

❖ Pharmaceutical Formulations

- a. Ferric ammonium citrate tablets
- b. Ferric ammonium citrate solution

❖ Market Preparations

- FERO-PLUS
- L-RED
- FEROGLO-HB

❖ Storage Conditions

- It is kept in well closed containers and protected from light.

❖ **Uses**

- Used in chronic kidney disease.



3.1.4 FERROUS ASCORBATE

- Ferrous Ascorbate is a combination of vitamin C and iron.
 - Iron works by replenishing the iron stores in your body and corrects iron deficiency anemia.
 - Vitamin C (ascorbate) is added to enhance the absorption of iron in the body.
- ❖ **Synonyms:** Iron(2+) L-ascorbate, L-Ascorbic acid, Iron complex.
- ❖ **Chemical Formula:** $C_{12}H_{16}FeO_{12}$.
- ❖ **Molecular Weight:** 406.08 g/mol.
- ❖ **Physical Properties**
- Appearance: Dark purplish black powder.
 - Taste: Typical ferrous salt taste.



❖ **Preparation**

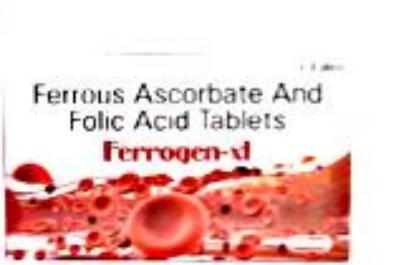
- The alkali or alkaline earth metal salts or its hydroxides are reacted with ferrous sulfate to get corresponding ferrous salts, which are reacted with ascorbic acid in an aqueous medium at slightly acidic or neutral condition followed by filtration to get ferrous ascorbate in mother liquor.

❖ **Pharmaceutical Formulations**

- Ferrous ascorbate capsules.
- Ferrous ascorbate syrup.

❖ Market Preparations

- FERROGEN-XT.
- FEBATE-XT.
- FERNIC-XT.
- Kryptofer-XT.



❖ Storage Conditions

- It should be stored in an air tight container protecting from light.
- It should be kept at room temperature.

❖ Uses

- The major activity of supplemental iron is in the prevention and treatment of iron deficiency anemia.
- Iron has putative immune-enhancing, anticarcinogenic and cognition-enhancing activities.

3.1.5 CARBONYL IRON

- Carbonyl iron is a highly pure iron.

❖ **Synonyms:** Feosol (Carbonyl Fe), Icar C, Icar Pediatric, and Irco.

❖ **Chemical Formula:** $\text{Fe}(\text{CO})_5$

❖ **Molecular Weight:** 195.9 g/mol

❖ **Preparation**

- $\text{Fe}(\text{CO})_5$ is produced by the reaction of fine iron particles with carbon monoxide.



❖ Properties

- It is a grey powder, composed of spherical micro particles.

❖ Pharmaceutical Formulations

- Tablets.
- Oral suspension.
- Capsule.
- Pellets.

❖ Market Preparations

- Carvifol
- Irolar
- Heamtone
- Carbojas Z



❖ Storage Conditions

- It should be stored in air tight container at room temperature.

❖ Uses

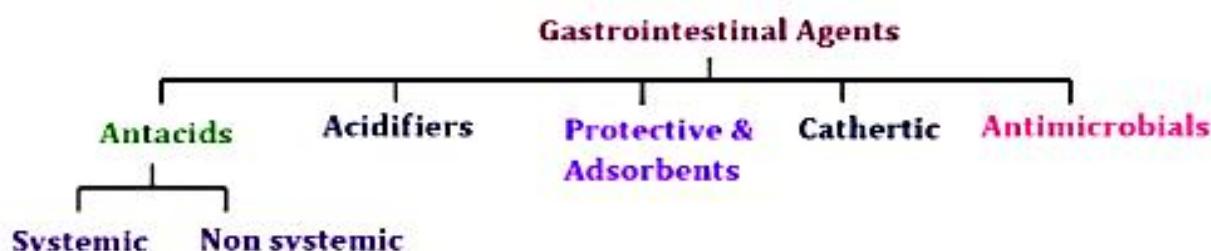
- As a dietary iron supplement.
- To treat iron deficiency anemia.

3.2 GASTRO-INTESTINAL AGENTS

- The **Gastro-Intestinal Tract (G.I.T.)** is one of the important body systems comprising of many organs.
- These include, the oral cavity of the mouth, oesophagus, stomach, small intestine (**Duodenum, Jejunum, and Ileum**), large intestine (**Cecum, Colon, and Rectum**) and anus.
- Also present are accessory organs contributing to the digestive process such as the salivary glands, pancreas, gallbladder, liver etc.
- Gastrointestinal agents, or **GIT** agents, are substances that have effects on the gastrointestinal tract (**GIT**), such as regulating gastric acidity, controlling gastrointestinal motility, increasing water flow, and improving digestion. The gastrointestinal tract stretches from the mouth to the anus.



- Mouth Oesophagus Stomach → Small intestine (duodenum, jejunum and ileum) → large intestine (Caecum and Colon) → Rectum → Anus.
- ❖ These drugs of inorganic origins are mainly divided into five main categories (thus, in scope of this chapter), namely;



Inorganic agents used to treat gastrointestinal disorders include-

1. Products for altering gastric pH: **Acidifying Agents:** Used to treat Achlorhydria (absence of HCl in the gastric secretion) e.g. Dilute HCl.
2. **Antacids:** Used to treat Hyperchlorhydria and peptic ulcer.
3. **Protectives** for intestinal inflammation.
4. **Adsorbents** for intestinal toxins.
5. **Cathartics** or laxatives for constipation.

3.2.1 INTRODUCTION OF ANTACID

- Antacids (**anti - against; acidus - acid**) are weak alkaline compounds used to neutralize hydrochloric acid in the stomach.
- Antacids are the substances which reduce gastric acidity resulting in an increase in the pH of stomach and duodenum.
- These are the agents or drugs which are used to neutralize excess gastric hydrochloric acid in stomach which may cause pain and ulcer and to inactivate the proteolytic enzyme, pepsin. Chemically, these are generally a weak base or basic salt.

3.2.2 Criteria of an Ideal Antacid Preparation

- Antacid should not get absorbable otherwise they can cause systemic alkalosis.
- Antacid should neither be laxative nor be constipated in action.
- It should be quick acting and exert its effect for a longer period of time.

- The antacid should buffer in the pH range of 4-6.
- Reaction of the antacid with gastric hydrochloric acid should not cause a large evaluation of gas.
- The antacid should probably inhibit pepsin.

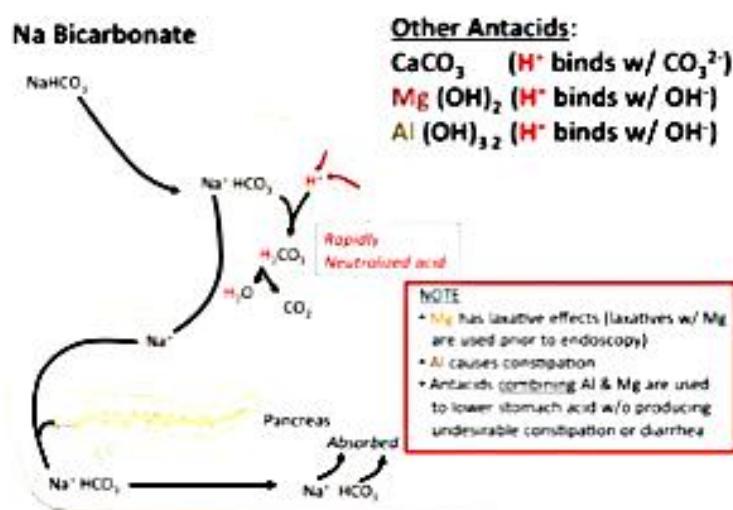


3.2.3 Classification of Antacids

NON-SYSTEMIC ANTACIDS	SYSTEMIC ANTACIDS
<ul style="list-style-type: none"> Non-systemic antacids are compounds that are not absorbed into the systemic circulation. Their anionic group neutralizes the H^+ ions in gastric acid. This releases their cationic group which combines with HCO_3^- from the pancreas to form an insoluble basic compound that is excreted in feces. 	<ul style="list-style-type: none"> Systemic antacids are absorbed into the systemic circulation. They have a cationic group that does not form insoluble basic compounds with HCO_3^-.
Example- Aluminum Hydroxide, Magnesium Hydroxide	Example- Sodium bicarbonate, Sodium citrate

3.2.4 Mechanism of Antacid

- They act by a neutralization reaction, i.e., they buffer gastric acid, so increase the pH, to decrease acidity in the stomach.



3.2.5 Uses of Antacids

- To treat peptic ulcer and gastro-oesophageal reflex.
- To treat heart burn and a growing hungry feeling between meals.
- To decrease gastric acidity which resulting in an increase in pH of the duodenum and stomach.

3.2.6 ALUMINIUM HYDROXIDE GEL

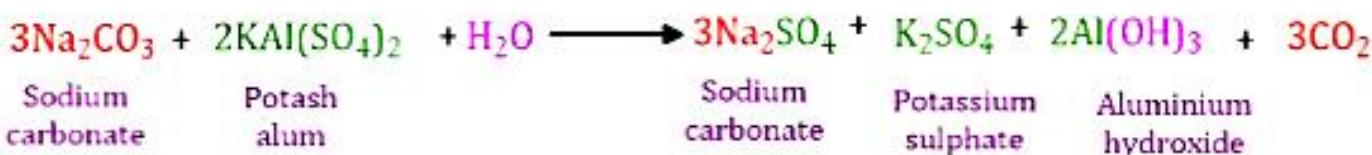
- Synonyms:** Hydrargillite.
- Chemical Formula:** Al(OH)₃.
- Molecular Mass:** 78.00 g/mol.
- IUPAC Name:** Aluminium hydroxide.
- Physical properties:**



- Appearance:** white amorphous powder.
- Odor:** Odourless.
- Taste:** tasteless.
- Aluminium hydroxide is amphoteric in nature, i.e., it has both basic and acidic properties.

❖ Preparation

- It is prepared by adding a hot solution of potash alum slowly with constant stirring to a hot solution of sodium carbonate. After complete removal of carbon dioxide, the precipitated aluminium hydroxide is filtered. It is washed thoroughly with hot water until it becomes free from sulphate ions.



❖ Pharmaceutical Formulations

- Aluminium hydroxide gel prepared in solution and suspension.
- Aluminium hydroxide gel present in market in the form of combination. Such as "Dried Aluminium hydroxide, Magnesium hydroxide & Simethicone suspension."

❖ Market Preparations

- Relaxid SM.
- Alqure.

❖ Storage Condition

- Store in a well-ventilated place. Keep container tightly closed.



❖ Uses

- Aluminium hydroxide used as gastric antacid.
- Aluminium hydroxide used in treatment of Gastro esophageal reflux disorder.
- Ulcer Protectives:** Basic aluminium hydroxide of sulfated sucrose is known as Sucralfate.
- In treatment of Zollinger-Ellison Syndrome.

3.2.7 MAGNESIUM HYDROXIDE

❖ **Synonyms:** Milk of Magnesia

❖ **Chemical Formula:** $Mg(OH)_2$

❖ **Molecular Mass:** 58.31 g/mol

❖ **IUPAC name:** Magnesium hydroxide

❖ **Physical Properties**

- Appearance: White amorphous powder
- Odour: Odourless
- Taste: Tasteless
- Mg^{2+} Salts or Oxide or Hydroxide acts as both antacids and laxative agents

❖ **Preparation**

- Magnesium hydroxide is produced by treating seawater with lime



❖ **Pharmaceutical Formulations**

- Magnesium hydroxide prepared in solution and suspension.
- Magnesium hydroxide present in market in the form of combination. Such as "Dried Aluminium hydroxide, Magnesium hydroxide & Simethicone suspension."

❖ **Market Preparations**

- Relaxid SM
- Alqure

❖ **Storage Condition**

- It is stored in Tightly-closed Containers.
- It should not be kept in a cold place.



❖ **Uses**

- Magnesium hydroxide is an excellent thermal conductor and poor electrical conductor.
- It is used in suspensions as a laxative or antacid. Used as a food additive.

- It is widely used in waste-water treatment.
- Used as a fire retardant.
- It is used in wet plate Collodian process as a photographic fixer.
- It is used in gold mining. Used in warehouses.

3.2.8 SODIUM BICARBONATE

❖ **Synonyms**

- Baking soda, Bread soda, Cooking soda, Bicarbonate of soda

❖ **Chemical Formula:** NaHCO_3

❖ **Molecular Mass:** 84.007 g/mol

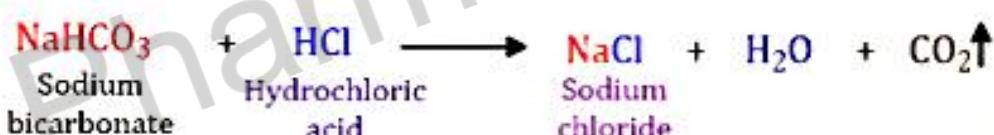
❖ **IUPAC Name:** Sodium hydrogen carbonate

❖ **Physical Properties**

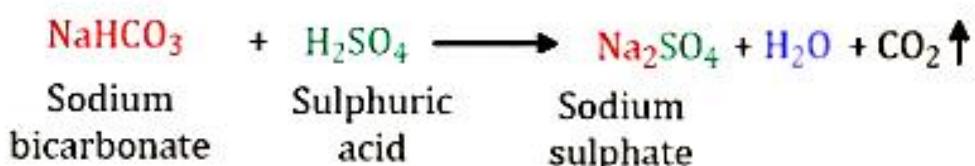
- Appearance: White crystalline powder or granules
- Solubility: Soluble in water and insoluble in alcohol
- Odor: Odourless
- Taste: Saline taste

❖ **Preparation**

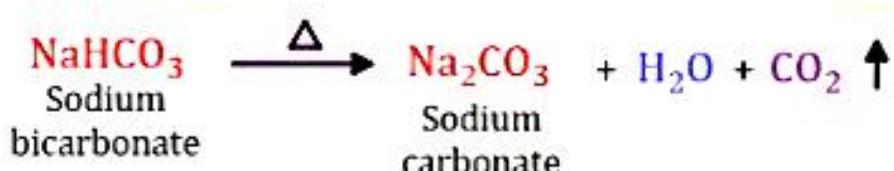
- When it reacts with hydrochloric acid, then it releases carbon dioxide.



- When it reacts with Sulphuric acid, then it forms sodium sulphate.



- On heating, sodium bicarbonate is decomposed into sodium carbonate and carbon dioxide.



❖ Pharmaceutical Formulation

- Tablet
- Capsule
- Injection
- Powder
- Drops



❖ Market Preparation

- Sodonate-500
- Sodibic
- SB-Carb



❖ Storage Condition

- It is kept in tightly closed Containers in a cool place.

❖ Uses

- Sodium bicarbonate is used in cooking (mainly), as an antacid and to prepare buffer solutions ($\text{NaHCO}_3 + \text{H}_2\text{CO}_3$).
- Its aqueous solutions are used as local applicents for burns, insect bites, etc.
- It is also used as an electrolyte replenisher and in the treatment of diarrhoea.
- Solutions of sodium bicarbonate are used as eye lotions, as ear drops, to soften and remove ear wax and as lubricating fluid for contact lenses.

3.2.9 CALCIUM CARBONATE

❖ **Synonyms:** Precipitated chalk.

❖ **Chemical Formula:** CaCO_3 .

❖ **Molecular Mass:** 100.0869 g/mol.

❖ **IUPAC name:** Calcium carbonate.

❖ Physical Properties

- It occurs as fine, white, micro-crystalline powder.
- It is odourless and tasteless.
- It is almost insoluble in water, alcohol and soluble in acetic acid, hydrochloric acid, nitric acid with effervescence.

❖ Preparation

- It is obtained by mixing solution of calcium chloride and sodium carbonate





❖ Pharmaceutical Formulation

- Tablet
- Pellets
- Suspension
- Powder



❖ Market Preparation

- Combination preparation of calcium carbonate present in the market.
- For example - Snucal, Dcalcium, Ricium.

❖ Storage Condition

- Calcium Carbonate should be stored a cool and dry place with tightly closed containers.

❖ Uses

- It is used widely as an effective dietary calcium supplement, as food additive, phosphate binder, or base material for medicinal tablets.
- It is also used as antacid, Antidiarrheal agent, insecticides, dentifrices (due to mild abrasive quality) and in cosmetics.
- It causes constipation and hence it is often used with magnesium hydroxide or magnesium carbonates, which have counter balancing laxative effects.
- Due to its alkali nature, it is used in agriculture for neutralize soil which is too acidic to harbour crops.
- It is also used for the formation of marble, limestone and classroom chalk.

3.2.10 ACIDIFYING AGENTS

- The drugs or agents which are used to increase metabolic acidosis and gastric hydrochloric acid.
- They are also known as acidifying reagents or acidifiers.
- Acidifying agents can be used to treat Achlorhydria.
- Example: Dilute HCl.



❖ Hypochlorhydria/Achlorhydria

- Achlorhydria occurs because of two reasons:
 - (a) When the gastric acid secretion is devoid of HCl, even after stimulating with histamine phosphate
 - (b) When the gastric secretion is devoid of HCl, but secreted upon stimulation with histamine phosphate.

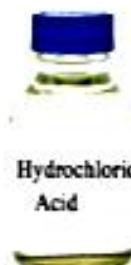
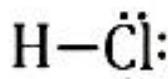
❖ Types of Acidifying Agents

- **Gastric acidifiers:** These are drugs which are used to restore temporarily the acidity of stomach in patients suffering from Achlorhydria or Hypochlorhydria.
- **Urinary acidifiers:** These are the drugs which are used to render acidic urine to enable treatment of some type of urinary tract disorders.
- **Systemic acidifiers:** These are the drugs which are able to neutralize the alkaline body fluids, particularly blood, in patients who are suffering from systemic alkalosis.
- **Acids:** Acids are used as pharmaceutical aids in the preparation, laboratory quality control etc.

3.2.11 HYDROCHLORIC ACID (HCl)

❖ Synonyms

- Muriatic acid
- Spirits of salt



Hydrochloric
Acid

❖ Chemical Formula: HCl

❖ Molecular Mass: 36.458 g/mol.

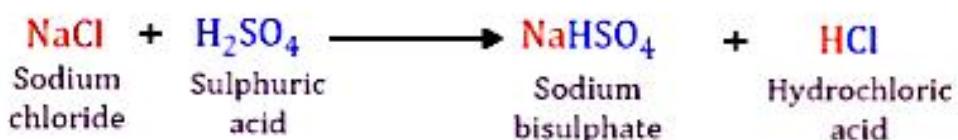
❖ Physical Properties

- Clear, Colorless, Fuming liquid & Pungent in odour.
- Hydrochloric acid is commonly known as spirit of salt, because it was first of all prepared by distilling sea salt with Sulphuric acid.

- Aqueous solution of hydrochloric acid contains 35-38% w/v of HCl.

❖ Preparation

- It is manufactured by the action of Sulphuric acid on sodium chloride.



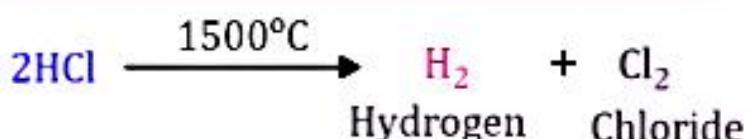
- Sodium bisulphate formed in the process is further mixed with some more quantity of sodium chloride and heated strongly in furnace to get more hydrogen chloride. So, the overall reaction is:

❖ Chemical properties:

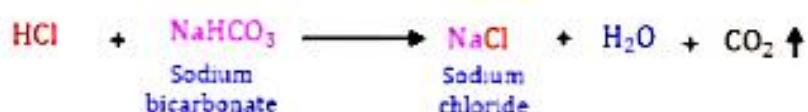
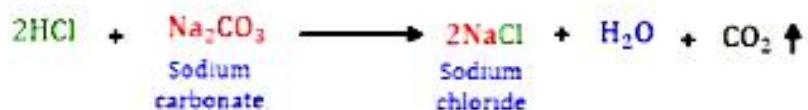
- (a) When it reacts with ammonia, then it forms dense colourless ammonium chloride.



- (b) At 1500°C , it dissociates into chloride and hydrogen.



- © When it reacts with bicarbonates and carbonates, then it released carbon dioxide.



❖ **Pharmaceutical Formulation**

- The salt combination preparation of hydrochloric acid present in the market.

❖ **Storage Condition**

- At a temperature of no more than 30°C, store in stoppered glass containers.
- For dilute HCl add the acid to water and store the diluted acid solution in a reagent bottle (never add the water to the acid).

❖ **Uses**

- It is mainly used as a pharmaceutical aid or as an acidifying agent.
- Used as gastric acidifier when levels of hydrochloric acid in gastric juice are low.
- Externally used as a solvent, catalyst in basic pharmaceutical and as acidifier.

3.2.12 PROTECTIVES AND ADSORBENTS

These are chemically inert substances which are used in the treatment of mild diarrhoea or dysentery or other disturbances of gastrointestinal tract because of their ability to adsorb gases, toxins and bacteria. Protective adsorbents are similar to adsorbents. They absorb moisture from the skin's surface, reducing irritation and mechanical friction while also inhibiting bacterial growth.

Protectives: A protective substance is one that shields the exposed surface from harmful stimuli. They're used to cover and protect ulcers, the surface of the epithelium, and wounds. Calamine, Silicone polymers, Talc, Titanium dioxide, Zinc oxide, and Zinc stearate are just a few examples.

❖ **CHARACTERISTICS OF PROTECTIVE AND ADSORBENT:**

- They are chemically inert and soluble substances. This reduces their interaction with 'tissues and limits their absorption through the skin, making them difficult to wash off.
- They can adsorb bacteria, viruses, toxins, and gases, among other things.
- They provide mechanical protection by forming a protective coating on the mucosa of the intestine. Many of these protectives are also adsorbents.
- They absorb moisture and act as cutaneous desiccants in their natural state.
- Protective coatings should not be applied to surfaces where fluid is leaking because cakes may form.
- As particle size decreases, protective and adsorbent activities increase because small particles have a larger surface area and adhere better to the skin's surface and adsorb moisture more efficiently.

- The fineness of the particles also makes substances easy to apply.

❖ **USES:**

- Protectives and adsorbents are frequently used to treat gastrointestinal disorders such as mild diarrhoea and dysentery, among other things.
- To form a protective layer on a painful ulcer in the GIT, protectives or protectants are used.
- Bacteria, viruses, toxins, and gases are adsorbents.

➤ **Examples of Protectives And Adsorbents**

- Activated charcoal, bismuth salts, and special clays are the ingredients. Typical examples include: Aluminium sulphate, Activated charcoal and Kaolin (light and heavy).

3.2.13 BISMUTH SUBCARBONATE

❖ **Synonyms:**

- Bismuth carbonate
- Basic bismuth carbonate

❖ **Chemical Formula: $(BiO)_2CO_3$**

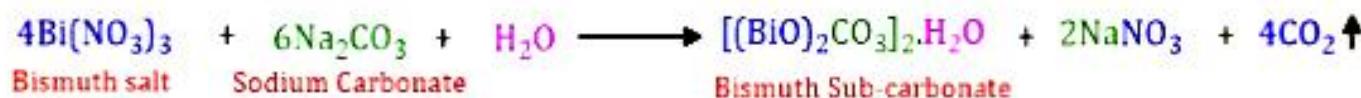
❖ **Molecular Mass: 509.97 g/mol**

❖ **Physical Properties**

- It's a colourless, heavy, micro-crystalline, odourless, and tasteless powder that's basic and slightly hygroscopic.
- It is insoluble in water, alcohol, and effervescent in nitric acid and hydrochloric acid.

❖ **Preparation**

- It is prepared by adding an acid solution of bismuth salt to a hot solution of sodium carbonate and stirring constantly.
- The precipitate is filtered and washed with an equal volume of cold water and dried at a temperature not above 60 °C. Repeated washing has to be avoided it tends to decompose sub carbonate into hydroxide.



❖ **Pharmaceutical Preparation**

- The combination preparation of Bismuth sub-carbonate present in the market.

❖ **Market Preparation**

- Combination preparation of Bismuth Sub-carbonate is: Chewable Tablet, tablets etc.

❖ **Storage Condition**

- Stored in dry and cool place.

❖ **Uses**

- Bismuth Sub-carbonate is used as an astringent and adsorbent.
- As an antacid it is very mild.
- It is used topically as a protective. It is given in varying doses in the treatment of diarrhea, dysentery and ulcerative colitis.

3.2.14 KAOLIN

❖ **Synonyms**

- China clay
- Argilla
- Porcelain clay

❖ **Chemical Formula:** $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

❖ **Physical Properties**

- It is odorless, tasteless, and white to yellowish or grayish powder.
- It has melting point $740 - 1785^\circ\text{C}$ and density 2.65 g/cm^3 .
- It is a light white powder, soft to touch.
- Insoluble in water, mineral acids and organic solvents.



❖ **Preparation**

- Kaolin is prepared when the rock in mines, excavated and the impurities are washed with water and then powdered.
- The rock is elutriated with water and large-sized particles are separated. On allowing the turbid liquid to settle, heavy kaolin containing particles of large size are separated and then dried.

❖ **Pharmaceutical Formulation**

- Kaolin formulate in the form of poultice & powder and combination form of suspension.

❖ **Market Preparation**

- Kaolin poultice.
- Kaolin clay.

❖ **Storage Condition**

- Stored in air-tight containers.

❖ **Uses**

- As an adsorbent for toxic substances from G.I.T. tract.
- Kaolin has traditionally been used internally to control diarrhea.
- Kaolin has also been used topically as an emollient and drying agent.
- It has also been used as a protectant for the temporary relief of anorectal itching and diaper rash.

3.2.15 CATHARTICS

- Cathartics are drugs or substances that used to relieve constipation or bring out defecation. They are beneficial in constipation and for expulsion of intestinal parasites.

- Purgatives are also cathartics which act similarly but generally consider as mild cathartics in their nature of action.



❖ **Mechanism of Action**

- Cathartics or Purgatives generally act by four different Mechanism they are follow as...

➤ **Stimulants**

- These are the drugs or chemicals which act by local irritation on intestinal tract and bring about stimulation of peristaltic activity. As they act directly on intestine and stimulate peristalsis they are termed as stimulants.
- Drugs like senna, Rhubarb, Cascara, Podophyllum, Castor oil, Aloe, Bisacodyl etc. belong to this class.

➤ Bulk Forming

- These are the agents which are able to increase bulk of intestinal contents. These are cellulose or non-digestible type of materials which swell considerably when wet and because of increased bulk stimulate peristalsis.
- Examples: Methylcellulose, Sodium CMC, gum, Isabgol etc.

➤ Osmotic Purgatives or Saline Cathartics

- These act by increasing the osmotic load of intestine by absorbing large quantity of water and thereby stimulate peristalsis.

➤ Lubricants

- In constipation, contents of intestine become hard because of absorption of water by body, there results difficulty in clearing of bowels. Substances such as liquid paraffin, glycerine, mineral oils etc. act as lubricants and cause smooth clearance of the fecal material.

❖ Uses of Cathartics

- To ease defecation in patients with painful haemorrhoids
- Rectal disorders and to avoid
- To avoid potentially hazardous rise in B.P. during defecation in patients with hypertension.
- To relieve acute constipation

3.2.16 MAGNESIUM SULPHATE

❖ Synonyms

- Epsom salts
- Bitter Salts

❖ Chemical Formula: $MgSO_4 \cdot 7H_2O$

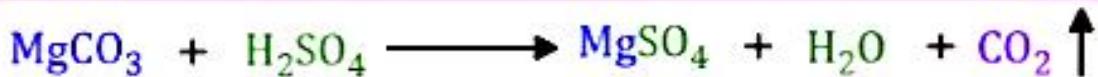
❖ Molecular Mass: 246.5 g/mol

❖ Physical Properties

- Appearance: White crystalline solid
- Odor: Odourless
- Taste: Bitter taste

❖ Preparation

- It is obtained by the action of dilute sulphuric acid on magnesium carbonate or magnesium oxide or from native carbonate.



- The solution is filtered.
- Filtrate is evaporated to crystallisation.
- Obtained the magnesium sulphate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) crystals.

❖ Pharmaceutical Formulation

- Suspension.
- Powder.
- Enema.
- Suppositories.
- Injection.



❖ Market Preparation

- Magnesium sulphate powder IP.
- Epsom salt.
- Magnesium sulphate injection USP.
- Combination of magnesium sulphate suspension.

❖ Storage Condition

- It is kept in tightly closed containers.

❖ Uses

- It is used as osmotic laxative (Saline Cathartics), in treatment of electrolyte deficiency, in wet dressing in boils, in treatment of Cholecystitis, Sea sickness.
- They may also be given for clearing bowels before surgery.