

# Pharmaceutical chemistry.

## Chapter—3 Inorganic pharmaceutical.

### Unit-2— Antacids.

**Antacids** are meant for neutralizing the gastric PH in stomach by binding or inhibiting the gastric receptor in our stomach. It inhibits the extra hydrochloric acid secretion in stomach and neutralizes the increasing level of hydrochloric acid.

Hydrochloric acid (HCl) is the highly acidic chemicals (PH about 1.5-2.5) which helps in the digestion process by activating the gastric enzymes. It is secreted by the parietal cells of the gastric gland. If concentration is increases then it may cause indigestion, heart burn, and gastric upset and gastrointestinal ulcer.

Most of antacids acts on  $H_2$  receptor and proton pump inhibitor (PPI) in our gastric canal and maintain the  $H^+$  ion concentration.

### Classification of Antacids

**On the basis of acting site it is divided into two categories—**

1.  **$H_2$ -receptor antagonist**— Cimetidine, Ranitidine, Femotidine.
2. **Proton Pump Inhibitor**— Esomeprazole, Omeprazole, Pantoprazole.

**On the basis of inorganic elemental nature it is divided into many categories—**

1. **Calcium containing antacids**— Calcium carbonate, Tribasic calcium phosphate.
2. **Magnesium containing antacids**— Magnesium hydroxide, magnesium carbonate, magnesium oxide, magnesium trisilicate.
3. **Aluminium containing antacids**— Aluminium hydroxide, aluminium phosphate, aluminium carbonate, dihydroxy aluminium sodium carbonate.
4. **Sodium containing antacids**— Sodium bicarbonate.

### 5. Combined antacids—

- Aluminium hydroxide gel and  $\text{Mg}(\text{OH})_2$ .
- Aluminium hydroxide gel and Magnesium trisilicate.
- Aluminium hydroxide gel and calcium carbonate.

**Note:** - calcium and aluminium antacids may cause the constipation and magnesium and aluminium antacids may cause the laxative effects.

### Aluminium hydroxide gel.

**Chemical formula—**  $\text{Al}(\text{OH})_3$

**Molar mass—** 78.00g/mol.

**Introduction—**It is also known as Aluminic acid, hydrated Alumina. It is the basic inorganic compounds which are reacts with the HCl and work quickly by lowering the acidic PH of gastric cavity. It does not affect on the acidic Production. Liquid antacids usually work faster/better than tablets or capsules.

#### **Properties—**

- **Color and state—**It is the white or pale yellow color amorphous powder.
- **Odor and taste—**it is the odorless with mucilaginous taste.
- **Solubility—**It is insoluble in water but soluble in acidic as well as basic medium.

**Pharmaceutical preparation—** Suspension, syrup, tablet, capsule, bolus.

**Brand/Market Name—** Digene, Gelusil, Vicid, Alquire, Asinil-T.

**Storage condition—** It is stored in well closed air resistance unopened container and keeps away from incompatible materials at room temperature and also away from the light and moisture.

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**Uses/Application**—Aluminium hydroxide is used to treat the gastric problem by neutralizing the increasing PH. It also provides relieve in heartburn, upset stomach, sour stomach.

Aluminium hydroxide is also used to reduce phosphate level in people with certain kidney conditions.

### Magnesium hydroxide.

**Chemical formula**—  $\text{Mg}(\text{OH})_2$

**Molar mass**— 58.32g/mol.

**Introduction**— It is also known as Milk of magnesia. It acts as the antacid by neutralizing the gastric PH since it reacts with the  $\text{H}^+$  of HCl and neutralize them and produce the water. It acts as laxative so increases the volume of feces in the intestine by stimulating the intestinal Motility.

On the commercial scale it is prepared by the reaction of calcium hydroxide or lime.



**Properties**—

- **Color and state**—It is the white color crystalline solid or powder.
- **Odor and taste**—It is the odorless with milky taste or chalky taste.
- **Solubility**—It is slightly soluble in Water.

**Pharmaceutical preparation**— Suspension, syrup, tablet, capsule

**Brand/Market Name**— Digene, Gelusil, Antanil plus, Cremaffin, Maalox.

**Storage condition**— It is stored in well closed air resistance unopened container and keeps away from incompatible materials at room temperature and also away from the light and moisture.

**Uses/Application**—

- Magnesium hydroxide reduces stomach acid, and increase water in the intestines which may induce bowel movements.
- Magnesium hydroxide is used as a laxative to relieve the constipation.
- It is also used as antacid to relieve indigestion, sour stomach, and heartburn.

### Magaldrate.

**Chemical formula**—  $\text{Al}(\text{OH})_3 \cdot \text{Mg}_2(\text{OH})_4 \cdot \text{H}_2\text{O}$       **Molar mass**— 212.67g/mol.

**Introduction**— Magaldrate is derived from the combination of the aluminium hydroxide and magnesium hydroxide so it is also called as Magnesium Aluminium monohydrate. it is widely uses in the gastric abnormalities. Magaldrate was first synthesized by the German Chemist Gunther Hallmann.

It is prepared by the reaction of active aluminium hydroxide and magnesium oxide/hydroxide in the presence of water, then obtain the megaldrate paste.

**Properties**—

- **Color and state**—it is the white color crystalline powder or paste.
- **Odor and taste**—It is the odorless with milky taste.
- **Solubility**—practically it is insoluble in water and ethanol and soluble in mineral acids.

**Pharmaceutical preparation**— Syrup, suspension, tablet, powder

**Brand/Market Name**—Gasorit, Novelta, metadrate, Pracid, Contacid.

**Storage condition**— It is stored in well closed air resistance unopened container and keeps away from incompatible materials at room temperature and also away from the light and moisture.

**Uses/Application**— Magaldrate is a common antacid drug that is used for the treatment of duodenal and gastric ulcers, esophagitis from gastroesophageal reflux disease (GERD).

It is also used during hyperphosphatemia.

### Sodium bicarbonate.

**Chemical formula**— $\text{NaHCO}_3$

**Molar mass**—84.01g/mol.

**Introduction**—Sodium bicarbonate commonly known as baking soda. It is the monosodium salt of carbonic acid shows antacid activity by neutralizing the excess gastric PH. Sodium bicarbonate and an acid agent react together to release  $\text{CO}_2$ , this property is used for the formulation of sparkling drinks.

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Large scale it is produced by the reaction of cold and concentrated solution of the sodium chloride (Brine solution) with ammonia and carbon dioxide in the presence of water.  $\text{NaCl} + \text{NH}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$ .

### Properties—

- **Color and state**—It is the white crystalline powder.
- **Odor and taste**—it is odorless with saline taste.
- **Solubility**—it is highly soluble in water, but practically insoluble in alcohol.
  - Sodium bicarbonate is a basic solution, if it is treated with the acid it gives effervescence due to release of  $\text{CO}_2$ .

**Pharmaceutical preparation**— Tablet, powder, ear drop, injection, capsule, sachet, syrup, suspension.

**Brand/Market Name**—Nodosis, Gaviscon, alka soda, rencarb, sodamint.

**Storage condition**— It is stored in well closed air resistance unopened container and keeps away from incompatible materials at room temperature and also away from the light and moisture.

**Uses/Application**—It is used for the treatment of metabolic acidosis in severe renal disease, uncontrolled diabetes, circulatory insufficiency due to shock or severe dehydration. It is also used to relieve heartburn, sour stomach, or acid indigestion by neutralizing excess stomach acid.

## Calcium Carbonate.

**Chemical formula**—  $\text{CaCO}_3$

**Molar mass**—100.0869g/mol.

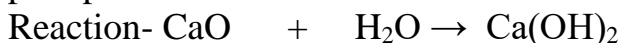
**Introduction**—It is also known as aragonite, calcite, and limestone, marble. Calcium carbonate shows wide range of activity in our body for healthy bones, muscles, nervous system and heart etc, by providing the calcium ion in our body. Calcium carbonate is widely used in the antacids preparation for relieving the heartburn, indigestion, and upset stomach. Calcium ions are also used in the water treatment and agricultural aspects. Overdose of calcium cause the hypercalcaemia and digestive problems.

- Calcium carbonate is prepared by the reaction of calcium oxide with water and carbon dioxide. Initially water is added to calcium oxide then it forms

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calcium hydroxide the carbon dioxide is passed through this solution to precipitate the desired calcium carbonate.



### Properties—

- **Color and state**— it is the whitish or milky crystalline powder.
- **Odor and taste**— it is odorless with bitter taste.
- **Solubility**— it is practically insoluble in water and ethanol.

**Pharmaceutical preparation**— Tablet, syrup, capsule, pills, Tooth paste, tooth powder, oral drop.

**Brand/Market Name**— Shelcal, calvitan, Acidocid SF, calcimax P etc.

**Storage condition**—It is stored in well closed air resistance unopened container and keep away from incompatible materials at room temperature and also away from the light and moisture.

### Uses/Application—

- It is used for water treatment. In water treatment it forms the complexes with other harmful metals.
- Calcium plays a vital role for the growth and maturation of the body like muscles, bones, teeth, and organs.
- Calcium carbonates acts as antacid and neutralizes the acidic PH and prevents the indigestion, heartburn, and gastric problems.