Tikrit university/college of pharmacy

Organic pharmaceutical chemistry
lab3
calcium carbonate synthesis

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Antacid

- **Antacids are medicines that counteract (neutralise) the acid in your stomach to relieve indigestion and heartburn** . Marketed antacids contain salts of aluminum, calcium, magnesium, or sodium.Some preparations contain a combination of two salts, such as magnesium carbonate and Calcium carbonate like rennie chewable tablets .

Antacids work quickly to neutralizingm the

amount of acid in your stomach to relieve symptoms .

Antacids don't treat the underlying causes of

Heartburn and indigestion

Antacids properties

1. Alkaline salt of metal
2. React with acidic solution to produce metal chloride and water
3. the pH of acidic stomach is ,1
   and afer buffering become closer to 7
   which is neutral .

$$Ca(OH)_{2(aq)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + 2H_2O_{(l)}$$
$$Mg(OH)_{2(aq)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + 2H_2O_{(l)}$$
$$Al(OH)_{3(aq)} + 3HCl_{(aq)} \rightarrow AlCl_{3(aq)} + 3H_2O_{(l)}$$

$$NaHCO_{3(s)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$$
$$Na_2CO_{3(s)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$$

Calcium carbonate chemical and physical Properties

Calcium carbonate is white powder. It has a density of 2.71 g/mL ,and a melting point of 1,339°C in its calcite form. Calcium carbonate is practically insoluble in water(,lm/gm (0.014_0.0066 insoluble in alcohol. Dissolves with effervescence in diluted acetic acid, in diluted hydrochloric acid and in diluted nitric acid, and the resulting solutions, after boiling, give positive tests for calcium .

.When heated to high temperatures, it decomposes to form calcium oxide with the release of carbon dioxide .

Chemical properties of calcium carbonate

- CaCO3 soluble in acidic solution and react to produce carbon dioxide Co2 and Calcium chloride Cacl2 and water as below:

Formula Equation

$$CaCO_{3(s)} + 2\,HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$$

- CaCO3 is insoluble in water because of the very strong electrostatic forces of attraction that exist in the calcium carbonate molecules. The forces are so strong that they make it impossible to break the bond between the calcium and carbonate ion, and do not let CaCO3 dissociate in water even when calcium carbonate is actually an ionic substance. The solubility product of CaCO3 is very low 3.3 * 10^-9 indicating that this compound is not soluble in water

Aplication of calcium carbonate

- Industrial aplication

Calcium Carbonate is employed largely in the paper and pulp industries. It can also be used as a pigment, making possible the production of a whiter and higher quality pigment compared to other minerals.Calcium carbonate is used in the construction industry as a filler in concrete, increasing its appearance and durability.The other application of calcium carbonate is in fertilizers in providing calcium to plants and pH stabilization of the soil.

Aplication of calcium carbonate

- Pharmaceutical application:

Calcium Carbonate Uses an Excipient

In oral solid dosage forms, Calcium carbonate functions as a filler –diluent and as a dry binder. It is widely used to formulate tablets and capsules, as well as granules and powders where the use of an inorganic, less abrasive filler-diluent is preferred over traditional fillers.

Calcium carbonate is often the preferred excipient in formulations where the active pharmaceutical ingredient is poorly soluble and/or present in low doses .

Use of Calcium Carbonate as an Absorbent for Oily liquids allowing them to be transformed into dry, highly compressible powders .

Application of Calcium Carbonate

- Medicinal application:

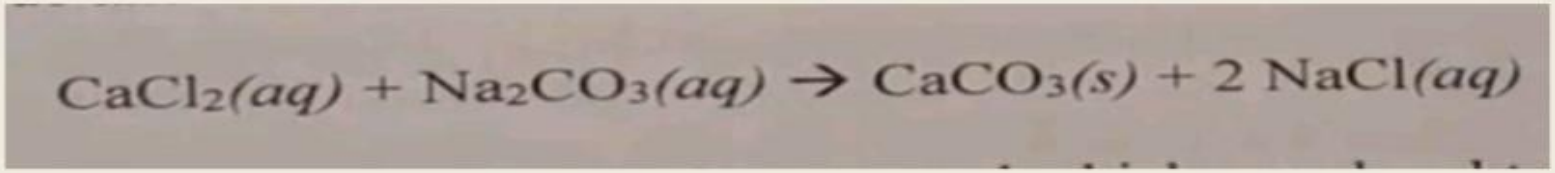
Calcium plays of key roles in cellular biochemistry and in the physiology of the living organisms. Calcium participates as a secondary messenger in signal-transduction pathway and is involved with the contraction of muscle cells and the release of neurotransmitters by nervous cells. Calcium is also the cofactor of many enzymes, and is essential for the maintenance of the elec-trical potential difference across cellular membranes.Finally, 70% of bone is made up of hydroxyapatite, a mineral composed of different calcium salt

Application of Calcium Carbonate

1. as an antacid in gastric hyperacidity for temporary relief of indigestion and heartburn .
2. As a calcium supplement for preventing and treating osteoporosis.,it must be taken always with vit D to increase the absorbtion of calcium, calcium carbonate is cheap and efective Source for calcium but calcium citrate is more easly absorbed by the body .
3. used therapeutically as a phosphate buffer in hemodialysis .

Synthesis of Calcium Carbonate

Calcium carbonate is basic compound with PH of aqueous solution is 8.5



Cacl2 M.wt =110.9g/mol

Na2Co3 M.wt=106g/mol

CaCl2 wt=0.5g

Na2Co3 wt =0.48g

Synthesis of Calcium Carbonate

- Synthesis:

1. dissolve each compound separatily with distill water.
2. Mixing the two solutions.
3. The result Will be aqueous solution of sodium chloride containing $CaCO_3$ precipitate .

- Separation of $CaCO_3$ from solution

1. Filteration :The sodium chloride Will be in the filtrate and $CaCO_3$ Will precipitated on filteri paper.
2. $CaCO_3$ may contain some water so should be evaporated