

Acid base lab determination of caco3 in toothpaste

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Calcium Carbonate in Toothpaste**

Uses of CaCO₃ in Toothpaste

- Acts as an abrasive to remove plaque and tartar
- Source of calcium for teeth remineralization
- Neutralizes acids produced by bacteria in the mouth

Reaction of CaCO₃ with Acid or Base

CaCO₃ reacts with acid, emitting carbon dioxide gas:



It does not react with bases.

Formation of CaCO₃

CaCO₃ is formed when calcium ions (Ca²⁺) react with carbonate ions (CO₃²⁻). These ions can come from:

- Acid-base reaction: $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- Precipitation from solution: $\text{CaCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{CaCO}_3 + 2\text{NaCl}$

Determination of Calcium Carbonate in Eggshells by Acid-Base Titration

1. Grind eggshells to obtain a powder.

2. Add excess HCl to dissolve the CaCO_3 , forming CaCl_2 .
3. Titrate the excess HCl with a known concentration of NaOH solution.
4. Calculate the amount of CaCO_3 present using stoichiometry.

Role of Calcium Carbonate in Teeth

- Provides calcium and carbonate ions for remineralization, strengthening enamel
- Neutralizes acids, preventing tooth decay

Purpose of Calcium in Toothpaste

- Strengthens teeth by replenishing calcium lost due to acid erosion
- Helps prevent tooth decay

Effect of pH on CaCO_3

- CaCO_3 dissolves in acidic solutions ($\text{pH} < 7$).
- It is stable in neutral solutions ($\text{pH} = 7$).
- It precipitates out of solution in basic solutions ($\text{pH} > 7$).

Effect of Acid on CaCO_3

Acid dissolves CaCO_3 , forming Ca^{2+} and CO_2 .

Acidity Expressed as CaCO_3

Acidity of water or other liquids is sometimes expressed in terms of equivalent CaCO_3 , which is the amount of CaCO_3 that would neutralize the same amount of acid present.

pH of CaCO_3 Solution

- Saturated CaCO_3 solution: $\text{pH} \approx 8.3$
- Dilute CaCO_3 solution: $\text{pH} < 8.3$

Methods for Determination of Calcium Carbonate

- Acid-base titration
- Gravimetric analysis
- X-ray diffraction
- Spectrophotometry

Determination of Carbonate by Acid-Base Titration

1. Add excess HCl to dissolve the CaCO_3 .
2. Titrate the excess HCl with a known concentration of NaOH solution.
3. Calculate the amount of carbonate present using stoichiometry.

pH Needed to Dissolve Calcium Carbonate

Around pH 5.5 or lower.

Calcium Carbonate in Toothpaste

- Amount: Varies, but typically 20-50%
- Abrasiveness: Yes, but less abrasive than other common abrasives like silica
- Purpose: Abrasive, calcium source, acid neutralizer

Calcium Carbonate Paste

- Used as a plaster in dentistry
- Made by mixing calcium carbonate powder with water

Uses of Calcium Carbonate

- Manufacturing of cement, glass, paper
- Acid neutralizer in food and pharmaceutical products
- Source of calcium in dietary supplements

Role of Calcium Phosphate in Dentistry

- Major component of tooth enamel

- Provides strength and hardness to teeth
- Helps prevent tooth decay

Most Important Chemical in Toothpaste

Fluoride

Purpose of Adding Calcium Carbonate

- To increase calcium availability
- To neutralize acids
- To provide abrasiveness

pH of CaCO_3 Solution

8.3

Acid or Base

Neutral

Magnesium Carbonate in Toothpaste

- Used as an anti-caking agent
- Prevents toothpaste components from clumping

Laboratory Uses of Calcium Carbonate

- As a standard for acid-base titrations
- In preparation of buffer solutions
- As a pH indicator

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