

TIKRIT UNIVERSITY
COLLEGE OF PHARMACY



ORGANIC PHARMACEUTICAL CHEMISTRY
LABRATORY
zinc sulfate

م. د. علي حسين مصطفى م. م. أحمد رافع
م. م. صباح فرحان. الصيدلاني محمود شاكر جابر

Zinc

- Zinc is a chemical element with the symbol Zn and atomic number 30. It is a bluish-white, lustrous, and relatively reactive metal that belongs to the group of transition metals. Zinc is commonly used in various applications due to its unique properties, such as its resistance to corrosion, its ability to conduct electricity, and its low melting point. It is also an essential micronutrient that plays a vital role in many biological processes, including growth and development, immune function, and wound healing. Zinc is found in many foods, including meat, seafood, dairy products, beans, and nuts, and is also available as a dietary supplement

Chemical properties of zinc

- **Reactivity:** Zinc is a moderately reactive metal that readily reacts with oxygen to form zinc oxide. It also reacts with acids to produce hydrogen gas and a zinc salt
- **Corrosion resistance:** Zinc has excellent corrosion resistance and is often used as a coating on steel to prevent rusting. This is due to the formation of a protective layer of zinc oxide and carbonate on the surface of the metal.
- **Electronegativity:** Zinc has a moderate electronegativity value, which means it can form both ionic and covalent compounds.
- **Oxidation states:** Zinc can exist in several oxidation states, the most common being +2. It can also exist in the +1 and +3 oxidation states, but these are less common.
- **Solubility:** Zinc is relatively insoluble in water, but it can dissolve in acids and alkalis.
- **Catalytic properties:** Zinc is an important catalyst in many biological processes and is also used as a catalyst in industrial processes such

Physical Properties of zinc

Here are some of the physical properties of zinc:

1. Appearance: Zinc has a bright, bluish-white appearance.
2. Density: The density of zinc is 7.14 grams per cubic centimeter.
3. Melting and boiling point: Zinc has a melting point of 419.53°C (787.15°F) and a boiling point of 907°C (1665°F).
4. State of matter: Zinc is a solid at room temperature.
5. Conductivity: Zinc is a good conductor of electricity and heat.
6. Crystal structure: Zinc has a hexagonal close-packed crystal structure

Medical application of zinc

- Zinc has a number of medical applications, as it is an essential mineral that plays a role in many bodily functions. Here are some of the medical applications of zinc:
 1. Immune system support: Zinc is important for maintaining a healthy immune system. It helps to activate T-cells, which are a type of white blood cell that plays a critical role in fighting off infections.
 2. Wound healing: Zinc is also involved in the process of wound healing. It helps to stimulate the production of new cells and tissues, which can speed up the healing process.
 3. Common cold prevention: Taking zinc supplements may help to prevent or reduce the duration of the common cold.

Medical application of zinc

- Diarrhea treatment: Zinc supplements can be effective in treating diarrhea, particularly in children. It has been shown to help reduce the duration and severity of diarrhea in those who are deficient in zinc.
- Age-related macular degeneration: Zinc has been found to be helpful in slowing the progression of age-related macular degeneration, a condition that can cause vision loss in older adults.

Zinc salt

- There are several types of zinc salts used in pharmacy. Some of the most common ones include:
 1. Zinc gluconate: This salt is commonly used as an oral supplement to help support immune function, wound healing, and growth and development.
 2. Zinc oxide: This salt is a common ingredient in sunscreens, diaper creams, and other topical skin care products due to its ability to protect the skin from UV rays and other irritants.
 3. Zinc sulfate: This salt is used as an oral supplement to treat zinc deficiencies, and is also used as a topical astringent and skin protectant.
 4. Zinc pyrithione: This salt is used as an active ingredient in anti-dandruff shampoos and other hair care products, as well as in topical creams and ointments to treat fungal infections.

Zinc sulfate

Chemical and physical properties

Molecular formula: ZnSO_4

Molecular weight: 161.47 g/mol

Appearance: Colorless crystalline solid

Solubility: Highly soluble in water, less soluble in alcohol

pH: Acidic (around 4.5)

Melting point: 680 °C (1,256 °F)

Boiling point: Decomposes before boiling

Density: 3.54 g/cm³

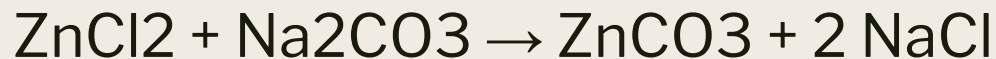
Color: White (anhydrous) or colorless (hydrated)

Zinc sulfate is also an oxidizing agent, which means that it can cause other substances to undergo oxidation reactions. It can react with bases to form zinc hydroxide, and it can react with acids to form zinc salts. Additionally, zinc sulfate can form complexes with other molecules, which can be used in various chemical.

Zinc sulfate synthesis

■ Synthesis of ZnCO₃ :

The reaction between zinc chloride (ZnCl₂) and sodium carbonate (Na₂CO₃) results in the formation of zinc carbonate (ZnCO₃) and sodium chloride (NaCl). This is a double displacement reaction and can be represented by the following balanced chemical equation:



In this reaction, the zinc chloride and sodium carbonate are both soluble in water, so they will dissociate into their respective ions in the solution. The zinc ions (Zn²⁺) will combine with the carbonate ions (CO₃²⁻) to form insoluble zinc carbonate (ZnCO₃), which will precipitate out of the solution. Meanwhile, the sodium ions (Na⁺) will combine with the chloride ions (Cl⁻) to form soluble sodium chloride (NaCl), which will remain in the solution. The reaction can be observed as a white precipitate forming in the solution, indicating the formation of insoluble zinc carbonate. This reaction is often used in the laboratory to confirm the presence of zinc ions in a solution, as the formation of the white precipitate is a characteristic of the presence of zinc ions.

Zinc sulfate synthesis

■ ZnSO₄ synthesis :

The reaction between zinc carbonate (ZnCO₃) and sulfuric acid (H₂SO₄) results in the formation of zinc sulfate (ZnSO₄), water (H₂O), and carbon dioxide (CO₂). This is an acid-base reaction and can be represented by the following balanced chemical equation:



In this reaction, the sulfuric acid will react with the zinc carbonate to form zinc sulfate and water, while carbon dioxide gas is produced as a byproduct. The reaction between an acid and a carbonate always produces carbon dioxide gas.

The zinc sulfate that is formed in the reaction will remain in solution, while the carbon dioxide will be released as a gas. This reaction can be used to prepare zinc sulfate in the laboratory or in industrial processes. It can also be used to demonstrate the formation of carbon dioxide gas in acid-base reactions or to test for the presence of carbonate ions in a solution.

The reaction can be observed as effervescence due to the production of carbon dioxide gas and the formation of a white precipitate of zinc sulfate if the solution is saturated. The reaction is exothermic and can be hazardous if not carried out carefully, as the sulfuric acid is a strong acid that can cause severe burns if it comes into contact with skin