



TIKRIT UNIVERSITY
COLLEGE OF PHARMACY

ORGANIC PHARMACEUTICAL CHEMISTRY
LABORATORY

magnesium citrate

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

Magnesium

- Magnesium, an abundant mineral in the body, is naturally present in many foods, added to other food products, available as a dietary supplement, and present in some medicines (such as antacids and laxatives). Magnesium is a cofactor in more than 300 enzyme systems that regulate diverse biochemical reactions in the body, including protein synthesis, muscle and nerve function, blood glucose control, and blood pressure regulation. Magnesium is required for energy production, oxidative phosphorylation, and glycolysis. It contributes to the structural development of bone and is required for the synthesis of DNA, RNA, and the antioxidant glutathione. Magnesium also plays a role in the active transport of calcium and potassium ions across cell membranes, a process that is important to nerve impulse conduction, muscle contraction, and normal heart rhythm

Chemical properties

1. **Reactivity:** Magnesium has a high reactivity with oxygen, chlorine, and other elements.
Combustibility: Magnesium burns easily when exposed to air, producing a bright white flame.
Corrosion resistance: Magnesium is resistant to most acids and alkalis.
Electronegativity: Magnesium has a low electronegativity, making it highly reactive with other elements.
Ionization energy: Magnesium has a low ionization energy, which means it readily gives up its outer electrons

Physical properties

- Physical properties of magnesium:
 1. Density: Magnesium is a lightweight metal with a density of 1.738 g/cm^3 .
 2. Melting and boiling point: Magnesium has a relatively low melting point of 651°C and a boiling point of $1,093^\circ\text{C}$.
 3. State: Magnesium is a solid metal at room temperature and pressure.
 4. Color: Pure magnesium has a silver-white color.
 5. Conductivity: Magnesium is a good conductor of electricity and heat.
 6. Solubility: Magnesium is insoluble in water but can dissolve in some acids and bases

Medical applications of magnesium

Magnesium has several medicinal applications due to its beneficial effects on the body's physiological processes. Here are some common medicinal applications of magnesium:

- **Dietary supplements:** Magnesium oxide and magnesium gluconate are commonly used as dietary supplements to treat magnesium deficiency and associated conditions such as muscle cramps, fatigue, and irregular heartbeats.
- **Antacids:** Magnesium hydroxide and magnesium carbonate are commonly used as antacids to treat acid reflux, heartburn, and indigestion. They work by neutralizing stomach acid .
- **Bronchodilators:** Magnesium sulfate is used as a bronchodilator to treat severe asthma attacks and other respiratory conditions.



Medical applications of magnesium

- **Anti-inflammatory effects:** Magnesium has anti-inflammatory properties that can help reduce inflammation and pain associated with conditions such as arthritis and other inflammatory diseases.
- **Migraine headaches:** Magnesium supplements may help prevent or treat migraine headaches, as low levels of magnesium have been linked to the development of migraines.
- **Cardiovascular health:** Magnesium supplements have been shown to reduce the risk of cardiovascular disease, hypertension, and stroke by regulating heart function and reducing inflammation.

Salt of magnesium available in pharmacy

- Magnesium citrate: Magnesium citrate is a salt that is commonly used as a laxative to treat constipation. It works by drawing water into the intestines and stimulating bowel movements.
- Magnesium glycinate and chelate : is a form of magnesium that has been bound to the amino acid . This form is believed to be highly absorbable and may be less likely to cause digestive upset than other forms of magnesium
- Magnesium hydroxide and carbonate : is a salt that is used as an antacid to treat acid reflux, heartburn, and indigestion. It works by neutralizing stomach acid
- magnesium sulfate :is a salt that is used to treat a variety of conditions including preeclampsia and eclampsia, asthma, and irregular heartbeats. It is also used as a source of magnesium in intravenous fluids for patients who cannot take oral supplements



Magnesium citrate

Magnesium citrate is a dietary supplement that combines magnesium with citric acid. It is commonly used as a laxative to relieve constipation, but it also has other potential health benefits. Magnesium is an essential mineral that is involved in numerous processes in the body, including:

1. Energy support
2. Nerve impulse transmission
3. muscle contraction
4. Metabolism
5. Bone mineralization
6. Relive anxiety



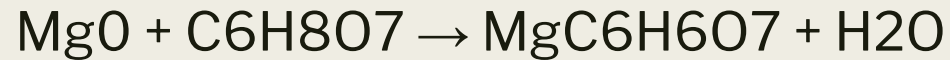
Chemical and physical properties

- Magnesium citrate is a chemical compound with the molecular formula $\text{Mg}_3(\text{C}_6\text{H}_5\text{O}_7)_2$. It is a white, odorless powder that is soluble in water. Magnesium citrate is a chelate of magnesium ions with citrate ions. The magnesium ion has a charge of +2, while the citrate ion has a charge of -3. The three magnesium ions in the compound form a complex with two citrate ions. Magnesium citrate has a molecular weight of 451.1 g/mol and a density of 1.7 g/cm³. It has a melting point of 135-150°C and decomposes at higher temperatures. Magnesium citrate has a pH of approximately 7.0 and is slightly acidic. In its liquid form, magnesium citrate is a clear, colorless liquid with a slightly salty taste. It is often flavored to make it more palatable. Magnesium citrate is also available in capsule and tablet form.

Magnesium citrate synthesis

When magnesium oxide are mixed with citric acid, they react to produce magnesium citrate and water.

The chemical equation for this reaction is:



This reaction is an example of a neutralization reaction, where an acid and a base (in this case, the citric acid and magnesium oxide) react to form a salt (magnesium citrate) and water.

Chemical tests for magnesium citrate

- **Flame Test:** When magnesium citrate is heated in a flame, it produces a bright white light that is characteristic of magnesium ions.
- **Complexation Test:** Magnesium ions in magnesium citrate can form a complex with a reagent like EDTA (ethylene diamine tetraacetic acid), which can be detected by a change in color or by the formation of a precipitate.
- **Acid-Base Titration:** Magnesium citrate can be titrated with a strong acid like hydrochloric acid, and the endpoint of the titration can be detected using a pH indicator like phenolphthalein.