Magnesium Chloride Hexahydrate

Comprehensive Industrial & Commercial Application Guide

Chemical Formula: MgCl2·6H2O **CAS Number:** 7791-18-6 **Grade:** Industrial / Technical

1. Product Overview & Physical Properties

Magnesium Chloride Hexahydrate (**MgCl2·6H2O**) is a highly soluble, crystalline compound widely utilized across multiple industries due to its excellent hygroscopic properties, environmental compatibility, and source efficiency for magnesium ions. Naturally occurring in brines and sea extractives, it appears as colorless, odorless deliquescent crystals or flakes.

Property	Value / Specification
Molecular Weight	203.31 g/mol
Assay (as MgCl2·6H2O)	98.0% – 101.0%
Appearance	White or translucent flakes / crystalline powder
Solubility in Water	167 g/100 mL (at 20°C)
Melting Point	117°C (Decomposes upon rapid heating)
pH (5% aqueous solution)	5.0 – 7.0

2. Key Industrial Applications

2.1 De-Icing and Anti-Icing (Road Infrastructure)

MgCl2·6H2O is a premier environmentally friendly solution for winter road safety. It performs efficiently at lower temperatures than sodium chloride, effectively melting ice down to ***-15°C*** (***5°F***).

- **Mechanism:** It depresses the freezing point of water, forming a liquid brine that prevents ice from bonding to road pavements.
- **Infrastructure Integrity:** It is significantly less corrosive to concrete and steel rebar compared to calcium chloride and rock salt, extending the lifespan of bridges and highways.

2.2 Dust Control and Soil Stabilization

Due to its powerful hygroscopic (moisture-absorbing) behavior, Magnesium Chloride is sprayed onto unpaved roads, construction sites, and agricultural tracks.

- **Process:** It continuously extracts moisture from the surrounding air, keeping the ground surface damp to bind fine dust particles together.

- **Benefits:** Minimizes airborne PM10 particulate matter, improves visibility for drivers, and reduces gravel road maintenance costs by preserving soil compaction.

2.3 Industrial Sorel Cement & Construction Materials

When combined with calcined magnesium oxide (**MgO**), Magnesium Chloride reacts to form Magnesium Oxychloride Cement (MOC), commonly known as Sorel Cement.

> Key Chemistry: 5MgO + MgCl2 + 13H2O → 5Mg(OH)2·MgCl2·8H2O (Phase 5 Crystal Form)

This cement matrix possesses high compressive strength, exceptional fire resistance, low thermal conductivity, and superb abrasion resistance. It is standard in heavy-duty industrial flooring, fireproofing panels, and soundproof insulation boards.

2.4 Wastewater Treatment and Environmental Management

In environmental engineering, **MgCl2** is used to remove high concentrations of phosphates and ammonium from municipal and industrial effluents by promoting the precipitation of struvite (**MgNH4PO4·6H2O**):

$$Mg^{2+} + NH4^{+} + PO4^{3-} + 6H2O \rightarrow MgNH4PO4{\cdot}6H2O\downarrow$$

It also functions as an efficient neutralizer for alkaline wastewater streams and acts as a coagulant/flocculant helper to settle suspended solids.

2.5 Agricultural and Animal Feed Supplement

Magnesium is a vital core element for chlorophyll production in plants and enzymatic functions in livestock. Magnesium Chloride Hexahydrate is formulated into liquid fertilizers to correct magnesium deficiencies (chlorosis) in high-value crops and added into cattle feed to prevent grass tetany during early spring grazing.

3. Solution Preparation & Mixing Guidelines

To prepare aqueous solutions of Magnesium Chloride Hexahydrate, follow these technical principles to ensure optimal dissolution and safety:

1. **Exothermic Dissolution:** Dissolving **MgCl2·6H2O** releases heat. Always add the flakes or crystals slowly into the water while agitating; *never add water directly to a large concentrated mass of dry crystals* to prevent localized flash boiling or splashing.
2. **Agitation:** Use mechanical paddle mixers or recirculation pumps. Continuous stirring prevents the heavy crystal flakes from settling at the base of the blending vessel.
3. **Water Quality:** Industrial or soft water is preferred. High-calcium hard water may cause minor turbidity or trace calcium sulfate/carbonate precipitation depending on local water chemistry.

4. Storage, Handling & Safety Precautions

4.1 Storage Environment

Because Magnesium Chloride Hexahydrate is extremely deliquescent, it will absorb ambient humidity and liquefy if left exposed to open air.

- Store in a cool, dry, well-ventilated warehouse facility.
- Keep containers or bags strictly airtight and sealed when not in use.
- Palletized storage should be wrapped securely in stretch film to prevent moisture ingress from the floor or ambient humidity.

4.2 Handling Personnel Protective Equipment (PPE)

While considered non-toxic and environmentally benign, the dust or concentrated solution can cause minor localized irritation.

- **Eyes:** Wear safety glasses or chemical splash goggles.
- **Skin:** Wear standard industrial protective gloves (Nitrile/PVC) and long-sleeved workwear.
- **Respiratory:** Use a standard dust mask (P2 or equivalent) if handling dry flakes in windy or enclosed conditions where airborne dust is generated.

4.3 Spill Management

Sweep up dry material spills immediately and transfer to clean, dry containers for reuse or disposal. Flush the remaining residue area with copious amounts of water. For liquid brine leaks, dike the perimeter using sandbags or inert absorbents, pump out excess liquid, and neutralize according to local municipal environmental bylaws.

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