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Magnesium Sulfate

$MgSO_4 \cdot xH_2O$
Sulfuric acid magnesium salt (1:1), hydrate;

Magnesium sulfate (1:1) monohydrate	138.36	CAS RN®: 14168-73-1; UNII: E2L2TK027P.
Magnesium sulfate (1:1) heptahydrate	246.47	CAS RN®: 10034-99-8; UNII: SK47B8698T.
Anhydrous	120.37	CAS RN®: 7487-88-9; UNII: ML30MJ2U7I.

DEFINITION

Magnesium Sulfate, rendered anhydrous by ignition, contains NLT 98.0% and NMT 102.0% of magnesium sulfate ($MgSO_4$).

IDENTIFICATION

- **A. Identification Tests—General ⟨191⟩, *Chemical Identification Tests*, *Sulfate***

  Sample solution: 50 mg/mL

  Acceptance criteria: Meets the requirements

- **B.** The retention time of the magnesium peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the *Assay*.

ASSAY

- **Procedure**

Use water with a resistivity of NLT 18 megohm-cm to prepare the solutions.

Mobile phase: 48 mM methanesulfonic acid. [Note—It is recommended to use suitable cation trapping techniques to ensure the *Mobile phase* is free of all cationic impurities.]

Diluent: 0.02 N hydrochloric acid

Standard stock solution: 5 mg/mL of USP Magnesium Sulfate RS prepared as follows. Transfer an appropriate portion of USP Magnesium Sulfate RS to a suitable volumetric flask. Add about 10% of the final volume of 6 N hydrochloric acid, and dissolve. Dilute with water to volume.

[Note—The *Standard stock solution* may be used to prepare the *System suitability solution*.]

Standard solution: 100 µg/mL of USP Magnesium Sulfate RS in water from the *Standard stock solution*

System suitability solution: 100 µg/mL of USP Magnesium Sulfate RS and 5 µg/mL of USP Calcium Carbonate RS in *Diluent*

Sample stock solution: Prepare 5 mg/mL of Magnesium Sulfate from the previously ignited Magnesium Sulfate as directed in the *Standard stock solution*.

Sample solution: 100 µg/mL of Magnesium Sulfate in water from the *Sample stock solution*

Chromatographic system

(See *Chromatography ⟨621⟩, System Suitability*.)

Mode: LC

Detector: Conductivity with suppression

Columns

Guard: 5-mm × 5-cm; 5.5-µm packing L84

Analytical: 5-mm × 25-cm; 5.5-µm packing L84

Column temperature: 40°

Flow rate: 1.0 mL/min

Injection volume: 10 µL

Run time: NLT 2 times the retention time of magnesium

System suitability

Samples: *Standard solution* and *System suitability solution*

[Note—The relative retention times for the magnesium and calcium ions are 1.0 and 1.3, respectively.]

Suitability requirements

Resolution: NLT 3.0 between the magnesium and calcium ions, *System suitability solution*

Tailing factor: NMT 2.0, *Standard solution*

Relative standard deviation: NMT 1.0%, *Standard solution*

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of magnesium sulfate ($MgSO_4$) in the portion of the ignited Magnesium Sulfate taken:

$$\text{Result} = (r_U/r_S) \times (C_S/C_U) \times 100$$

r_U = peak response of magnesium from the *Sample solution*

r_S = peak response of magnesium from the *Standard solution*

C_S = concentration of USP Magnesium Sulfate RS in the *Standard solution* (µg/mL)

C_U = concentration of Magnesium Sulfate in the *Sample solution* (µg/mL)

Acceptance criteria: 98.0%–102.0% on the anhydrous by ignition basis

IMPURITIES

• **Chloride and Sulfate ⟨221⟩, *Chloride***

Sample: 1.0 g

Acceptance criteria: The *Sample* shows no more chloride than corresponds to 0.20 mL of 0.020 N hydrochloric acid (0.014%).

Change to read:

• ▲**Iron ⟨241⟩, *Procedures, Procedure 1***▲ (CN 1-Jun-2023)

Magnesium Sulfate intended for use in preparing nonparenteral dosage forms

Sample solution: Dissolve 0.50 g in 40 mL of water.

Analysis: Proceed as directed in the chapter.

Acceptance criteria: NMT 20 µg/g

Magnesium Sulfate intended for use in preparing parenteral dosage forms

[Note—Rinse all glassware used in this test with *Dilute hydrochloric acid*.]

Dilute hydrochloric acid: 1 mL of hydrochloric acid diluted with water to 1000 mL

Solution A: 500 mg/mL of ammonium acetate in water

Solution B: 13.4 mg/mL of ascorbic acid in water. Use this solution on the day prepared.

Color reagent: 3.8 mg/mL of 3-(2-pyridyl)-5,6-di-(2-furyl)-1,2,4-triazine-5',5"-disulfonic acid, disodium salt in *Solution A*. Shake by mechanical means, if necessary. Use this solution on the day prepared.

Standard stock solution: 1.0 µg/mL of iron, from *Standard Iron Solution* in *Dilute hydrochloric acid*

Standard solutions: To 3 separate 50-mL volumetric flasks transfer 2.0, 5.0, and 10.0 mL of *Standard stock solution*, and dilute each with *Dilute hydrochloric acid* to 35 mL. These solutions contain 2.0, 5.0, and 10.0 µg of iron, respectively.

Sample solution: Transfer 10.0 g of Magnesium Sulfate to a 50-mL volumetric flask, add *Dilute hydrochloric acid* to 35 mL, and sonicate, if necessary, to dissolve.

Blank: Transfer 35 mL of *Dilute hydrochloric acid* to a 50-mL volumetric flask.

Instrumental conditions

(See *Ultraviolet-Visible Spectroscopy ⟨857⟩*.)

Mode: UV-Vis

Analytical wavelength: 594 nm

Analysis

Samples: *Standard solutions*, *Sample solution*, and *Blank*

To each of the flasks containing the *Standard solutions*, *Sample solution*, and the *Blank* add 5 mL of *Solution B* and 5 mL of *Color reagent*. Dilute each solution with *Dilute hydrochloric acid* to volume, mix, and allow to stand for 10 min.

Plot the absorbance values of the *Standard solutions* versus their iron contents, in µg, and draw the straight line best fitting the 3 plotted points. From the graph, determine the iron content, *C*, in µg, of the *Sample solution*.

Calculate the content, in µg/g, of iron in the portion of Magnesium Sulfate taken:

$$\text{Result} = C/W$$

C = content of iron in the *Sample solution* (µg)

W = weight of Magnesium Sulfate in the *Sample solution* (g)

Acceptance criteria: NMT 0.5 µg/g

Change to read:

• ▲**Selenium ⟨291⟩, *Procedures, Procedure 1***▲ (CN 1-Jun-2023)

Test solution: 200 mg in 50 mL of 0.25 N nitric acid

Acceptance criteria: NMT 30 µg/g

SPECIFIC TESTS

• **pH ⟨791⟩**

Sample solution: 50 mg/mL

Acceptance criteria: 5.0–9.2

• **Loss on Drying ⟨731⟩**

Analysis: Dry at 105° for 2 h.

Acceptance criteria: NMT 2% for the anhydrous form

• **Loss on Ignition ⟨733⟩**

Sample: 1 g

Analysis: Weigh the *Sample* in a crucible, heat at 105° for 2 h, then ignite in a muffle furnace at 450 ± 25° to constant weight.

Acceptance criteria

Monohydrate: 13.0%–16.0%

Dried form: 22.0%–28.0%

Heptahydrate: 40.0%–52.0%

ADDITIONAL REQUIREMENTS

• **Packaging and Storage:** Preserve in tight containers.

• **Labeling:** The label states whether it is the monohydrate, the dried form, or the heptahydrate. Magnesium Sulfate intended for use in preparing parenteral dosage forms is so labeled. Magnesium Sulfate not intended for use in preparing parenteral dosage forms is so labeled. In addition, it may be labeled also as intended for use in preparing nonparenteral dosage forms.

• **USP Reference Standards ⟨11⟩**

USP Calcium Carbonate RS

USP Magnesium Sulfate RS

Auxiliary Information - Please check for your question in the FAQs before contacting USP.

Topic/Question	Contact	Expert Committee
MAGNESIUM SULFATE	Documentary Standards Support	SM52020 Small Molecules 5
REFERENCE STANDARD SUPPORT	RS Technical Services RSTECH@usp.org	SM52020 Small Molecules 5

Chromatographic Database Information: Chromatographic Database

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