

Status: Currently Official on 17-Feb-2025
Official Date: Official as of 01-Jun-2024
Document Type: USP Monographs
DocId: GUID-E54F5407-FABC-404C-8C31-B3394DC1D19C_5_en-US
DOI: https://doi.org/10.31003/USPNF_M89840_05_01
DOI Ref: h3a8r

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Zinc Sulfate

$\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$

Sulfuric acid, zinc salt (1:1), hydrate;

Zinc sulfate (1:1) monohydrate 179.45 CAS RN[®]: 7446-19-7; UNII: PTX099XSF1.

Zinc sulfate (1:1) heptahydrate 287.54 CAS RN[®]: 7446-20-0; UNII: N57JI2K7WP.

Anhydrous 161.44 CAS RN[®]: 7733-02-0; UNII: 0J6Z13X3WO.

DEFINITION

Zinc Sulfate contains one or seven molecules of water of hydration. The monohydrate form contains NLT 89.0% and NMT 90.4% of zinc sulfate (ZnSO_4), corresponding to NLT 99.0% and NMT 100.5% of zinc sulfate monohydrate ($\text{ZnSO}_4 \cdot \text{H}_2\text{O}$). The heptahydrate form contains NLT 55.6% and NMT 61.0% of zinc sulfate (ZnSO_4), corresponding to NLT 99.0% and NMT 108.7% of zinc sulfate heptahydrate ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$).

IDENTIFICATION

- **A.** The retention time of the zinc peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the Assay.
- **B.** [IDENTIFICATION TESTS—GENERAL \(191\), Chemical Identification Tests, Sulfate](#): Meets the requirements

ASSAY

Change to read:

• PROCEDURE

Diluent, Mobile phase, ▲ and ▲ (IRA 1-Jun-2024) Post-column derivatization reagent ▲ (IRA 1-Jun-2024): Proceed as directed in [Zinc Determination \(591\), Procedure, Ion Chromatographic Method](#).

Standard solution: Equivalent to 40 µg/mL of zinc sulfate in *Diluent* from [USP Zinc Sulfate RS](#)

Sample solution: 44 µg/mL of zinc sulfate monohydrate or 71 µg/mL of zinc sulfate heptahydrate, equivalent to 40 µg/mL of zinc sulfate, in *Diluent* from Zinc Sulfate

Chromatographic system: Proceed as directed in [Zinc Determination \(591\), Procedure, Ion Chromatographic Method](#), except for the *Columns*.

Columns

Guard: 4.0-mm × 5-cm; 9-µm packing [L100](#). [NOTE—Alternatively, a 4.0-mm × 0.5-cm; 4.6-µm packing [L91](#) column may be used.]

Analytical: 4.0-mm × 25-cm; 9-µm packing [L100](#). [NOTE—Alternatively, a 4.0-mm × 25-cm; 4.6-µm packing [L91](#) column may be used.]

▲ System suitability

Sample: *Standard solution*

Suitability requirements

Tailing factor: NMT 2.0

Relative standard deviation: NMT 0.73% ▲ (IRA 1-Jun-2024)

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of zinc sulfate (ZnSO_4) in the portion of Zinc Sulfate taken:

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

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

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

C_S = equivalent concentration of zinc sulfate in the *Standard solution* (µg/mL)

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

Acceptance criteria

Monohydrate: 89.0%–90.4% of zinc sulfate (ZnSO_4), corresponding to 99.0%–100.5% of zinc sulfate monohydrate ($\text{ZnSO}_4 \cdot \text{H}_2\text{O}$)

Heptahydrate: 55.6%–61.0% of zinc sulfate (ZnSO_4), corresponding to 99.0%–108.7% of zinc sulfate heptahydrate ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$)

IMPURITIES

- [ARSENIC \(211\)](#), [Procedures, Procedure 1 and Procedure 2, Procedure 1: Colorimetry](#)

Sample solution: Dissolve a portion equivalent to 215 mg of zinc sulfate in 35 mL of [water](#).

Acceptance criteria: NMT 14 ppm

Change to read:

- [LEAD \(251\)](#), [Procedures, Procedure 1: Chemical Method](#)

▲ **Potassium cyanide solution:** Prepare as directed in [\(251\)](#).▲ (IRA 1-Jun-2024)

Standard solution: Combine 5 mL of [water](#), 0.50 mL of [standard lead solution TS](#), and 10 mL of *Potassium cyanide solution* (▲100 mg/mL▲ (IRA 1-Jun-2024)) in a color-comparison tube.

Sample solution: Dissolve an amount equivalent to 0.25 g of zinc sulfate in 5 mL of [water](#), and transfer the solution to a similar, matched color-comparison tube. Add 10 mL of *Potassium cyanide solution* (▲100 mg/mL▲ (IRA 1-Jun-2024)), and allow the mixture to become clear.

Analysis: To the *Standard solution* and the *Sample solution* add 0.1 mL of [sodium sulfide TS](#). Mix the contents of each tube, and allow to stand for 5 min.

Acceptance criteria: Viewed downward over a white surface, the *Sample solution* is not darker than the *Standard solution* (NMT 20 ppm).

- **ALKALIES AND ALKALINE EARTHS**

Sample solution: Dissolve an amount equivalent to 1.12 g of zinc sulfate in 150 mL of [water](#) in a 200-mL volumetric flask. Add sufficient [ammonium sulfide TS](#) to precipitate the zinc completely, and dilute with [water](#) to volume. Pass through a dry filter, and discard the first portion of the filtrate.

Analysis: To 100 mL of the *Sample solution* filtrate add a few drops of [sulfuric acid](#), evaporate to dryness in a tared dish, and ignite to constant weight.

Acceptance criteria: The weight of the residue is NMT 5 mg (0.9%).

SPECIFIC TESTS

- **ACIDITY**

Sample solution: Equivalent to 28 mg/mL of zinc sulfate

Acceptance criteria: The *Sample solution* is not colored pink by [methyl orange TS](#).

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in tight containers.
- **LABELING:** The label indicates whether it is the monohydrate or the heptahydrate. Label any oral or parenteral preparations containing Zinc Sulfate to state the content of elemental zinc.
- **USP REFERENCE STANDARDS (11).**
[USP Zinc Sulfate RS](#)

Auxiliary Information - Please [check for your question in the FAQs](#) before contacting USP.

Topic/Question	Contact	Expert Committee
ZINC SULFATE	Documentary Standards Support	SM32020 Small Molecules 3
REFERENCE STANDARD SUPPORT	RS Technical Services RSTECH@usp.org	SM32020 Small Molecules 3

Chromatographic Database Information: [Chromatographic Database](#)

Most Recently Appeared In:

Pharmacopeial Forum: Volume No. 49(6)

Current DocID: GUID-E54F5407-FABC-404C-8C31-B3394DC1D19C_5_en-US

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