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# Zinc Oxide Neutral

ZnO 81.39

## DEFINITION

Zinc Oxide Neutral, freshly ignited, contains NLT 95.0% and NMT 98.0% of zinc oxide (ZnO).

## IDENTIFICATION

- **A.** When strongly heated, it assumes a yellow color that disappears on cooling.
- **B.** The retention time of the zinc peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the Assay.

## ASSAY

### PROCEDURE

Proceed as directed in [Zinc Determination \(591\), Ion Chromatographic Method](#).

**Diluent:** 0.2% (w/v) [hydrochloric acid](#)

**Standard solution:** 20 µg/mL of [USP Zinc Oxide RS](#) in *Diluent*, prepared as directed in the chapter

**Sample solution:** 20 µg/mL of Zinc Oxide Neutral from the freshly ignited Zinc Oxide Neutral in *Diluent*, prepared as directed in the *Standard solution*

### Analysis

**Samples:** *Standard solution* and *Sample solution*

Calculate the percentage of zinc oxide (ZnO) in the portion of Zinc Oxide Neutral 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*

$C_S$  = concentration of [USP Zinc Oxide RS](#) in the *Standard solution* (µg/mL)

$C_U$  = concentration of Zinc Oxide Neutral in the *Sample solution* (µg/mL)

**Acceptance criteria:** 95.0%–98.0%

## IMPURITIES

### CHLORIDE AND SULFATE (221), Sulfate

**Standard solution:** 0.020 N [sulfuric acid](#)

**Sample:** 0.1 g

**Acceptance criteria:** The *Sample* shows no more sulfate than corresponds to 2.3 mL of the *Standard solution* (2.2%).

### Change to read:

- ▲ [ARSENIC \(211\), Procedures, Procedure 1](#) ▲ (CN 1-JUN-2023) : NMT 2 ppm

### LEAD

**Sample solution:** Add 2 g to 20 mL of water, and stir well. Add 5 mL of [glacial acetic acid](#), and warm on a steam bath until the solution is dissolved.

**Analysis:** Add 5 drops of [potassium chromate TS](#).

**Acceptance criteria:** No turbidity or precipitate is produced.

### Change to read:

### MERCURY

**Diluent A:** Carefully add 50 mL of [nitric acid](#) to 450 mL of water, and mix.

**Diluent B:** Carefully add 10 mL of [nitric acid](#) to 490 mL of water, and mix.

**Aqua regia:** [NOTE—Prepare immediately before use.] [Hydrochloric acid](#) and [nitric acid](#) (3:1)

**Stannous sulfate solution:** [NOTE—The mixture is a suspension and should be stirred continuously during use.] Add 25 g of stannous sulfate to 250 mL of [0.5 N sulfuric acid](#).

**Sodium chloride–hydroxylamine sulfate solution:** 120 mg/mL each of [sodium chloride](#) and hydroxylamine sulfate in water

**Potassium permanganate solution:** 50 mg/mL of [potassium permanganate](#) in water

**Standard stock mercury solution:** [NOTE—Use of a commercially prepared mercury standard is recommended.] 1.0 mg/mL of mercury from mercuric chloride in *Diluent A*

**Standard working mercury solution:** 0.5 µg/mL of mercury in *Diluent B*, from *Standard stock mercury solution*

**Standard solutions:** Transfer 1-, 2-, 3-, and 4-mL aliquots of *Standard working mercury solution* to four separate 300-mL biological oxygen-demand (BOD) bottles. To each bottle add 5 mL of water and 5 mL of *Aqua regia*. Heat the bottle for 2 min in a water bath at 95°. Cool, and add 50 mL of water and 15 mL of *Potassium permanganate solution*. Mix thoroughly, and place in a water bath for 30 min at 95°. Cool, add 5 mL of *Sodium chloride–hydroxylamine sulfate solution*, and dilute with water to 200 mL. These solutions contain the equivalent of 2.5, 5, 7.5, and 10 ng/mL of mercury, respectively.

**Sample solution:** Transfer 2.0 g of Zinc Oxide Neutral into a 300-mL BOD bottle. To the bottle add 5 mL of water and 5 mL of *Aqua regia*. Heat the sample in a water bath for 2 min at 95°. Cool, and add 50 mL of water and 15 mL of *Potassium permanganate solution*. Mix thoroughly, and place in a water bath for 30 min at 95°. Cool, add 5 mL of *Sodium chloride–hydroxylamine sulfate solution*, and dilute with water to 200 mL.

**Blank solution:** To a 300-mL BOD bottle add 5 mL of water and 5 mL of *Aqua regia*. Heat the solution for 2 min in a water bath at 95°. Cool, and add 50 mL of water and 15 mL of *Potassium permanganate solution*. Mix thoroughly, and place in a water bath for 30 min at 95°. Cool, add 5 mL of *Sodium chloride–hydroxylamine sulfate solution*, and dilute with water to 200 mL.

**Mercury detection instrument and Aeration apparatus:** Proceed as directed in [▲Mercury \(261\), Procedures, Procedure 2 and Procedure 3▲](#)

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**Analysis:** Add 5 mL of *Stannous sulfate solution* to a *Standard solution*, and immediately insert the bottle into the *Aeration apparatus*. Measure the absorbances of the *Standard solutions*. Repeat with the remaining *Standard solutions* and *Sample solution*. Perform a blank determination using the *Blank solution*, and make any necessary corrections. Plot the absorbances of the *Standard solutions* versus concentrations, in µg/mL, and draw the straight line best fitting the plotted points. From the graph so obtained, determine the concentration, in ppm of mercury, in the *Sample solution*.

**Acceptance criteria:** NMT 1 ppm

• **IRON AND OTHER HEAVY METALS**

**Sample solution:** Use the solution from the test for *Carbonate and Color of Solution*.

**Analysis:** Cool two separate 5-mL aliquots of the *Sample solution*. Add [potassium ferrocyanide TS](#) to the first aliquot, and add [sodium sulfide TS](#) to the second aliquot.

**Acceptance criteria:** White precipitates are formed in both aliquots.

• **MAGNESIUM OXIDE**

**Blank:** Carefully add 10 mL of concentrated [nitric acid](#) to 490 mL of water, and mix.

**Standard solution:** [NOTE—Use of a commercially prepared magnesium–inductively coupled plasma standard solution is recommended.] 25 µg/mL of magnesium in *Blank*

**Sample solution:** 4 mg/mL of Zinc Oxide Neutral in *Blank*

**Instrumental conditions**

(See [Plasma Spectrochemistry \(730\)](#).)

**Mode:** Inductively coupled plasma–atomic emission spectrometry

**Analytical wavelength:** 279.1 nm

**Analysis**

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

Calculate the percentage of magnesium oxide in the portion of Zinc Oxide Neutral taken:

$$\text{Result} = (C_U/C_S) \times (M_{r1}/M_{r2}) \times 100$$

$C_U$  = concentration of magnesium in the *Sample solution*, determined from the instrument (µg/mL)

$C_S$  = concentration of Zinc Oxide Neutral in the *Sample solution* (µg/mL)

$M_{r1}$  = molecular weight of magnesium oxide, 40.30

$M_{r2}$  = molecular weight of magnesium, 24.31

**Acceptance criteria:** NMT 0.7%

- [Loss on Ignition \(733\)](#).

**Sample:** 1 g

**Analysis:** Ignite the *Sample* at 750° for 15 min.

**Acceptance criteria:** NMT 5.0%

**SPECIFIC TESTS**

- **ALKALINITY**

**Analysis:** Mix 1.0 g with 10 mL of hot water, and add two drops of [phenolphthalein TS](#).

**Acceptance criteria:** No color change occurs.

- **CARBONATE AND COLOR OF SOLUTION**

**Analysis:** Mix 2.0 g with 10 mL of water, add 30 mL of 2 N [sulfuric acid](#), and heat on a steam bath, with constant stirring.

**Acceptance criteria:** No effervescence occurs and the resulting solution is clear and colorless. [NOTE—Use this solution in the test for *Iron and Other Heavy Metals*.]

**ADDITIONAL REQUIREMENTS**

- **PACKAGING AND STORAGE:** Preserve in tight containers, and store at room temperature.
- **LABELING:** Label it to indicate that it is for use in sunscreen preparations only.

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

Topic/Question	Contact	Expert Committee
ZINC OXIDE NEUTRAL	<a href="#">Documentary Standards Support</a>	SM32020 Small Molecules 3
REFERENCE STANDARD SUPPORT	RS Technical Services <a href="mailto:RSTECH@usp.org">RSTECH@usp.org</a>	SM32020 Small Molecules 3

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