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Titanium Dioxide

TiO_2 79.87

Titanium oxide (TiO_2) CAS RN®: 13463-67-7.

DEFINITION

Titanium Dioxide contains NLT 99.0% and NMT 100.5% of titanium dioxide (TiO_2), calculated on the dried basis. If labeled as attenuation grade, then Titanium Dioxide contains NLT 99.0% and NMT 100.5% of TiO_2, calculated on the ignited basis. Attenuation grade material may contain suitable coatings, stabilizers, and treatments to assist formulation.

[NOTE—If labeled as attenuation grade, then all tests and assays are conducted on uncoated, untreated material. For UV attenuation grade, the test for *Loss on Drying* does not apply. The FDA requires the content of lead to be NMT 10 ppm (µg/g), that of antimony to be NMT 2 ppm (µg/g), and that of mercury to be NMT 1 ppm (µg/g) (21 CFR 73.1575).]

IDENTIFICATION

• **A.**

Sample: 500 mg

Analysis: Add 5 mL of sulfuric acid to the *Sample*, and heat gently. After fumes of sulfur trioxide appear, continue heating for a minimum of 10 s. Cool the suspension, and cautiously dilute with water to 100 mL. Filter, and to 5 mL of the clear filtrate, add a few drops of hydrogen peroxide TS.

Acceptance criteria: A yellow-red to orange-red color develops immediately.

ASSAY

• **PROCEDURE**

Sample solution: Transfer 300 mg of Titanium Dioxide to a 250-mL beaker. Add 20 mL of sulfuric acid and 7–8 g of ammonium sulfate. Mix, heat on a hot plate until fumes of sulfur trioxide appear, and continue heating over a strong flame until the solution is complete, or until it is apparent that the undissolved residue is siliceous matter. Cool, cautiously dilute with 100 mL of water, stir, heat carefully to boiling while stirring, and allow the insoluble matter to settle. Filter, transfer the entire residue to the filter, and wash thoroughly with cold 2 N sulfuric acid. Dilute the filtrate with water to 200 mL, and cautiously add about 10 mL of ammonium hydroxide.

Blank: 200 mL of 2 N sulfuric acid

Titrimetric system

(See *Titrimetry* ⟨541⟩.)

Mode: Direct titration

Titrant: 0.1 N potassium permanganate VS

Endpoint detection: Visual

Analysis: Prepare a zinc amalgam column in a 25-cm Jones reductor tube, placing a pledget of glass wool in the bottom of the tube, and filling the constricted portion of the tube with zinc amalgam prepared as follows. Add 20- to 30-mesh zinc to mercuric–chloride solution (1 in 50), using about 100 mL of the solution for each 100 g of zinc, and after about 10 min, decant the solution from the zinc, then wash the zinc by decantation. Wash the zinc amalgam column with 100-mL portions of 2 N sulfuric acid until 100 mL of the washing does not decolorize 1 drop of 0.1 N potassium permanganate.

Place 50 mL of ferric ammonium sulfate TS in a 1000-mL suction flask, and add 0.1 N potassium permanganate until a faint pink color persists for 5 min. Attach the Jones reductor tube to the neck of the flask, and pass 50 mL of 2 N sulfuric acid through the reductor at a rate of about 30 mL/min. Pass the *Sample solution* through the reductor at the same rate, and follow with 100 mL each of 2 N sulfuric acid and of water. During these operations, keep the reductor filled with a solution or water above the upper level of the amalgam. Taking precautions against the admission of atmospheric oxygen, gradually release the suction, wash down the outlet tube of the reductor and the sides of the receiver, and titrate immediately with *Titrant*. Perform a blank determination, and make any necessary correction.

Calculate the percentage of titanium dioxide (TiO_2) in the sample taken:

$$\text{Result} = \{[(V_S - V_B) \times N \times F]/W\} \times 100$$

V_S = *Titrant* volume consumed by the *Sample* (mL)

V_B = *Titrant* volume consumed by the *Blank* (mL)

N = actual normality of the *Titrant* (mEq/mL)

F = equivalency factor, 79.88 mg/mEq

W = *Sample* weight (mg)

Acceptance criteria: 99.0%–100.5% on the dried basis; if labeled as attenuation grade, 99.0%–100.5% on the ignited basis

IMPURITIES

Change to read:

• ▲**Arsenic ⟨211⟩, *Procedures, Procedure 1*** ▲(CN 1-Jun-2023)

Test preparation: Add 3.0 g of Titanium Dioxide to a 250-mL conical flask fitted with a thermometer and a vapor outlet. Add 50 mL of water, 500 mg of hydrazine sulfate, 500 mg of potassium bromide, 20 g of sodium chloride, and 25 mL of sulfuric acid. Arrange to collect the evolved vapors in 52 mL of water contained in the arsine generator flask, heat the test specimen to 90°, and maintain the temperature at 90°–100° for 15 min. Add 3 mL of hydrochloric acid to the solution in the generator flask.

Analysis: Follow the *Procedure* in the chapter, omitting the addition of 20 mL of 7 N sulfuric acid.

Acceptance criteria: Any red color produced by the *Test preparation* does not exceed that produced by the *Standard Preparation* (NMT 1 µg/g).

SPECIFIC TESTS

• **Loss on Drying ⟨731⟩**

Analysis: Dry at 105° for 3 h

Acceptance criteria: NMT 0.5%

• **Loss on Ignition ⟨733⟩**

Sample: 2 g (previously dried sample). If labeled as attenuation grade, 4 g

Analysis: Ignite the *Sample* at 800 ± 25° to constant weight.

Acceptance criteria: NMT 0.5%; if labeled as attenuation grade, NMT 13%

• **Water-Soluble Substances**

Sample suspension: Suspend 4.0 g in 50 mL of water, mix, and allow to stand overnight.

Analysis: Transfer the *Sample suspension* to a 200-mL volumetric flask, add 2 mL of ammonium chloride TS, and mix. If the Titanium Dioxide does not settle, add another 2-mL portion of ammonium chloride TS. Allow the suspension to settle, dilute with water to volume, mix, and pass through a double thickness of fine-porosity filter paper, discarding the first 10 mL of the filtrate. Collect 100 mL of the clear filtrate, transfer to a tared platinum dish, evaporate on a hot plate to dryness, and ignite at a dull red heat to constant weight.

Acceptance criteria: The residue weighs NMT 5 mg (NMT 0.25%).

• **Acid-Soluble Substances**

Sample suspension: Suspend 5.0 g in 100 mL of 0.5 N hydrochloric acid, and heat on a steam bath for 30 min, with occasional stirring.

Analysis: Pass the *Sample suspension* through an appropriate filter medium until clear. Wash with three 10-mL portions of 0.5 N hydrochloric acid. Evaporate the combined filtrate and washings to dryness, and ignite at a dull red heat to constant weight.

Acceptance criteria: The residue weighs NMT 25 mg (NMT 0.5%).

ADDITIONAL REQUIREMENTS

• **Packaging and Storage:** Preserve in well-closed containers.

• **Labeling:** If intended for UV-attenuation, the material is labeled as attenuation grade. If intended for UV-attenuation, and any added coatings, stabilizers, or treatments are used, label it to indicate the name and amount of the additives.

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

Topic/Question	Contact	Expert Committee
TITANIUM DIOXIDE	Documentary Standards Support	SE2020 Simple Excipients
REFERENCE STANDARD SUPPORT	RS Technical Services RSTECH@usp.org	SE2020 Simple Excipients

Chromatographic Database Information: Chromatographic Database

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