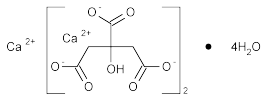
Calcium Citrate



$C_{12}H_{10}Ca_3O_{14} \cdot 4H_2O$ 570.49

1,2,3-Propanetricarboxylic acid, 2-hydroxy-, calcium salt (2:3), tetrahydrate;
Calcium citrate (3:2), tetrahydrate [5785-44-4].

DEFINITION

Calcium Citrate contains four molecules of water of hydration. When dried at 150° to constant weight, it contains NLT 97.5% and NMT 100.5% of $Ca_3(C_6H_5O_7)_2$.

IDENTIFICATION

- **A.**
  Analysis: Dissolve 0.5 g in a mixture of 10 mL of water and 2.5 mL of 2 N nitric acid. Add 1 mL of mercuric sulfate TS, heat to boiling, and add 1 mL of potassium permanganate TS.
  Acceptance criteria: A white precipitate is formed.
- **B.**
  Sample: 0.5 g of Calcium Citrate
  Analysis: Ignite completely the *Sample* at as low a temperature as possible, cool, and dissolve the residue in dilute glacial acetic acid (1:10). Filter, and add 10 mL of ammonium oxalate TS to the filtrate.
  Acceptance criteria: A voluminous white precipitate that is soluble in hydrochloric acid is formed.

ASSAY

- **PROCEDURE**
  Sample solution: Dissolve 350 mg of Calcium Citrate, previously dried at 150° to constant weight, in 12 mL of 0.5 M hydrochloric acid, and dilute with water to about 100 mL.
  Analysis: While stirring the *Sample solution*, add 30 mL of 0.05 M edetate disodium VS from a 50-mL buret. Add 15 mL of 1 N sodium hydroxide and 300 mg of hydroxy naphthol blue, and continue the titration to a blue endpoint. Each mL of 0.05 M edetate disodium is equivalent to 8.307 mg of calcium citrate $(Ca_3(C_6H_5O_7)_2)$.
  Acceptance criteria: 97.5%–100.5% on the dried basis

IMPURITIES

- **ARSENIC,** *Method I* ⟨**211**⟩
  Test preparation: Dissolve 1 g of Calcium Citrate in 5 mL of 3 N hydrochloric acid, and dilute with water to 35 mL.
  Acceptance criteria: NMT 3 ppm

Delete the following:

- **HEAVY METALS,** *Method I* ⟨**231**⟩
  Test preparation: Dissolve 1 g of Calcium Citrate in a mixture of hydrochloric acid and water (2:20). Add 1.5 mL of ammonium hydroxide, and dilute with water to 25 mL.
  Acceptance criteria: NMT 20 ppm (Official 1-Jan-2018)
- **LEAD** ⟨**251**⟩
  Test preparation: Dissolve 0.5 g of Calcium Citrate in 20 mL of 3 N hydrochloric acid. Evaporate this solution on a steam bath to 10 mL, dilute with water to 20 mL, and cool. Use 5 mL of *Diluted Standard Lead Solution* (5 µg of Pb) for the test.
  Acceptance criteria: NMT 10 ppm
- **LIMIT OF FLUORIDE**
  [NOTE—Prepare and store all solutions in plastic containers.]
  Standard stock solution: 1000 µg/mL of fluoride ion from USP Sodium Fluoride RS in water
  Standard solution: 5 µg/mL of fluoride ion from *Standard stock solution*. [NOTE—Prepare on the day of use.]
  Linearity solution A: Transfer 1.0 mL of the *Standard solution* to a 250-mL plastic beaker. Add 50 mL of water, 5 mL of 1 N hydrochloric acid, 10 mL of 1.0 M sodium citrate, and 10 mL of 0.2 M edetate disodium. If necessary, adjust with 1 N sodium hydroxide or 1 N hydrochloric acid to a pH of 5.5. Transfer to a 100-mL volumetric flask, and dilute with water to volume. This solution contains 0.05 µg/mL of fluoride.
  Linearity solution B: Transfer 5.0 mL of the *Standard solution* to a 250-mL plastic beaker, and proceed as directed for *Linearity solution A* beginning with "Add 50 mL of water". This solution contains 0.25 µg/mL of fluoride.
  Linearity solution C: Transfer 10.0 mL of the *Standard solution* to a 250-mL plastic beaker, and proceed as directed for *Linearity solution A* beginning with "Add 50 mL of water". This solution contains 0.50 µg/mL of fluoride.
  Sample solution: Transfer 1.0 g of Calcium Citrate to a 100-mL beaker. Add 10 mL of water and, while stirring, 10 mL of 1 N hydrochloric acid. When dissolved, boil rapidly for 1 min, transfer the solution to a 250-mL plastic beaker, and cool in ice water. Add 15 mL of 1.0 M sodium citrate and 10 mL of 0.2 M edetate disodium, and adjust with 1 N sodium hydroxide or 1 N hydrochloric acid to a pH of 5.5. Transfer this solution to a 100-mL volumetric flask, and dilute with water to volume.
  Electrode system: Use a fluoride-specific, ion-indicating electrode and a silver–silver chloride reference electrode connected to a pH meter capable of measuring potentials with a minimum reproducibility of ±0.2 mV (see *pH* ⟨791⟩).
  Analysis
  Samples: *Linearity solution A*, *Linearity solution B*, *Linearity solution C*, and *Sample solution*
  Transfer 50 mL of each *Linearity solution A*, *Linearity solution B*, and *Linearity solution C* to separate 250-mL plastic beakers, and measure the potential of each solution with the *Electrode system*. Between each reading wash the electrodes with water, and absorb any residual water by blotting the electrodes dry. Plot the logarithms of the fluoride concentrations (0.05, 0.25, and 0.50 µg/mL, respectively) versus potential to obtain a Standard response line.
  Transfer 50 mL of the *Sample solution* to a 250-mL plastic beaker, and measure the potential with the *Electrode system*. From the measured potential and the Standard response line determine the concentration, *C*, in µg/mL, of fluoride ion in the *Sample solution*. Calculate the percentage of fluoride in the specimen taken by multiplying *C* by 0.01.
  Acceptance criteria: NMT 0.003%
- **LIMIT OF ACID-INSOLUBLE SUBSTANCES**
  Sample solution: Dissolve 5 g of Calcium Citrate by heating with a mixture of hydrochloric acid and water (10:50) for 30 min.
  Analysis: Filter, wash, and dry at 105° for 2 h the residue so obtained.
  Acceptance criteria: The weight of the residue is NMT 10 mg (0.2%).

SPECIFIC TESTS

- **LOSS ON DRYING** ⟨**731**⟩**:** Dry a sample at 150° for 4 h: it loses from 10.0% to 13.3% of its weight.

ADDITIONAL REQUIREMENTS

- **PACKAGING AND STORAGE:** Preserve in well-closed containers.
- **USP REFERENCE STANDARDS** ⟨**11**⟩
  USP Sodium Fluoride RS