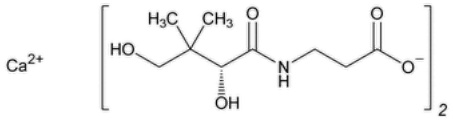
Status: Currently Official on 14-Feb-2025
Official Date: Official as of 01-Dec-2023
Document Type: USP Monographs
DocId: GUID-2ABC90FA-F72D-4CD8-A2CF-90C09578D047_5_en-US
DOI: https://doi.org/10.31003/USPNF_M11910_05_01
DOI Ref: l6vo3

Calcium Pantothenate



$C_{18}H_{32}CaN_2O_{10}$ 476.53

β-Alanine, *N*-(2,4-dihydroxy-3,3-dimethyl-1-oxobutyl)-, calcium salt (2:1), (*R*)-;

Calcium D-pantothenate (1:2) CAS RN®: 137-08-6; UNII: 568ET80C3D.

DEFINITION

Calcium Pantothenate is the calcium salt of the dextrorotatory isomer of pantothenic acid. It contains NLT 98.0% and NMT 102.0% of calcium pantothenate ($C_{18}H_{32}CaN_2O_{10}$), calculated on the dried basis.

IDENTIFICATION

- **A. Spectroscopic Identification Tests ⟨197⟩, *Infrared Spectroscopy*:** 197K
- **B. Identification Tests—General ⟨191⟩, *Chemical Identification Tests, Calcium***

  Sample solution: 50 mg/mL

  Acceptance criteria: Meets the requirements
- **C. Optical Rotation ⟨781S⟩, *Procedures, Specific Rotation***

  Sample solution: 50 mg/mL in water

  Acceptance criteria: +25.0° to +27.5°

ASSAY

Change to read:

- **Procedure**

  ▲**Mobile phase:** Dissolve 1.56 g of monobasic sodium phosphate in 900 mL of water, and adjust the pH to 2.5 with concentrated *ortho*-phosphoric acid. Add 10 mL of acetonitrile and dilute with water to 1000 mL.

  System suitability solution: 0.04 mg/mL of USP Calcium Pantothenate RS and 0.1 mg/mL of USP Pantolactone RS in water

  Standard solution: 0.5 mg/mL of USP Calcium Pantothenate RS in water

  Sample solution: 0.5 mg/mL of Calcium Pantothenate in water

  Chromatographic system

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

  Mode: LC

  Detector: UV 200 nm

  Column: 3.0-mm × 15-cm; 3.5-µm packing L1

  Column temperature: 35°

  Flow rate: 1.2 mL/min

  Injection volume: 5 µL

  System suitability

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

  [Note—The relative retention times for pantolactone and pantothenic acid are 0.8 and 1.0, respectively.]

  Suitability requirements

  Resolution: NLT 3.0 between pantolactone and pantothenic acid peaks, *System suitability solution*

  Relative standard deviation: NMT 2.0%, *Standard solution*

  Analysis

  Samples: *Standard solution* and *Sample solution*

  Calculate the percentage of calcium pantothenate ($C_{18}H_{32}CaN_2O_{10}$) in the portion of Calcium Pantothenate taken:

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

  r_U = peak area of pantothenic acid from the *Sample solution*

r_S = peak area of pantothenic acid from the *Standard solution*

C_S = concentration of USP Calcium Pantothenate RS in the *Standard solution* (mg/mL)

C_U = concentration of Calcium Pantothenate in the *Sample solution* (mg/mL)

▲ (USP 1-Dec-2023)

Acceptance criteria: 98.0%–102.0% on the dried basis

OTHER COMPONENTS

• **Content of Calcium**

Sample: 800 mg of Calcium Pantothenate

Blank: 150 mL of water containing 2 mL of 3 N hydrochloric acid

Titrimetric system

(See *Titrimetry* ⟨541⟩.)

Mode: Direct titration

Titrant: 0.05 M edetate disodium VS

Endpoint detection: Visual

Analysis: Dissolve the *Sample* in 150 mL of water containing 2 mL of 3 N hydrochloric acid. Add 15 mL of 1 N sodium hydroxide and 300 mg of hydroxy naphthol blue, and titrate with *Titrant* to a distinct blue endpoint. Perform the blank determination.

Calculate the percentage of calcium (Ca) in the *Sample* taken:

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

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

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

M = actual molarity of the *Titrant* (mmol/mL)

F = equivalency factor, 40.08 mg/mmol

W = *Sample* weight (mg)

Acceptance criteria: 8.2%–8.6% on the dried basis

Add the following:

▲IMPURITIES

• **Beta Alanine and Other Aminocarboxylic Acid Impurities**

Sample: 8.000 g of Calcium Pantothenate

Blank: 100 mL of water and 25 mL of formaldehyde solution

Titrimetric system

(See *Titrimetry* ⟨541⟩.)

Mode: Direct titration

Titrant: 0.1 N sodium hydroxide VS

Endpoint detection: Potentiometric

Analysis: Dissolve the *Sample* in 40 mL of water and dilute with the same solvent to 100 mL. Add 25 mL of formaldehyde solution and titrate with *Titrant*. Perform the blank determination.

Calculate the percentage of β-alanine 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, 89.09 mg/mEq

W = *Sample* weight (mg)

Acceptance criteria: NMT 0.5%

• **Other Related Substances**

Mobile phase and **Chromatographic system:** Proceed as directed in the *Assay*.

Standard solution: 0.004 mg/mL of USP Calcium Pantothenate RS, 0.04 mg/mL of USP Sodium D-Pantoate RS, and 0.02 mg/mL of USP Pantolactone RS in water

Sample solution: 4 mg/mL of Calcium Pantothenate in water

System suitability

Sample: *Standard solution*

[NOTE—The relative retention times for pantoic acid, pantolactone, and pantothenic acid are 0.5, 0.8, and 1.0, respectively.]

Suitability requirements

Resolution: NLT 3.0 between pantolactone and pantothenic acid peaks

Relative standard deviation: NMT 5.0% for pantoic acid, pantolactone, and pantothenic acid peaks

Analysis

Samples: *Standard solution* and *Sample solution*

Run time: 30 min

Calculate the percentage of pantoic acid in the portion of Calcium Pantothenate taken:

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

r_U = peak area of pantoic acid from the *Sample solution*

r_S = peak area of pantoic acid from the *Standard solution*

C_S = concentration of USP Sodium D-Pantoate RS in the *Standard solution* (mg/mL)

C_U = concentration of Calcium Pantothenate in the *Sample solution* (mg/mL)

M_{r1} = molecular weight of pantoic acid, 148.16

M_{r2} = molecular weight of sodium pantoate, 170.14

Calculate the percentage of pantolactone in the portion of Calcium Pantothenate taken:

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

r_U = peak area of pantolactone from the *Sample solution*

r_S = peak area of pantolactone from the *Standard solution*

C_S = concentration of USP Pantolactone RS in the *Standard solution* (mg/mL)

C_U = concentration of Calcium Pantothenate in the *Sample solution* (mg/mL)

Disregarding any peak due to beta alanine and other aminocarboxylic acid impurities with relative retention times below 0.2, calculate the percentage of β-alanyl pantothenamide and any unspecified impurity in the portion of Calcium Pantothenate taken using the concentration of calcium pantothenate in the *Standard solution*:

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

r_U = peak response of β-alanyl pantothenamide or any unspecified impurity from the *Sample solution*

r_S = peak response of pantothenic acid from the *Standard solution*

C_S = concentration of USP Calcium Pantothenate RS in the *Standard solution* (mg/mL)

C_U = concentration of Calcium Pantothenate in the *Sample solution* (mg/mL)

Acceptance criteria: See *Table 1*. The reporting threshold is 0.05%.

Table 1

Name	Relative Retention Time	Acceptance Criteria, NMT (%)
Pantoic acid	0.5	1.0
Pantolactone	0.8	0.5
Pantothenic acid	1.0	—
β-Alanyl pantothenamide	1.7	0.25

[a] Excludes beta alanine and other aminocarboxylic acid impurities.	—	0.2
▲ (USP 1-Dec-2023) Total impurities[a]	—	1.5

SPECIFIC TESTS

- **Alkalinity**

  Sample: 1.0 g

  Analysis: Dissolve the *Sample* in 15 mL of carbon dioxide-free water in a small flask. As soon as the solution is complete, add 1.0 mL of 0.10 N hydrochloric acid, and then add 0.05 mL of phenolphthalein TS.

  Acceptance criteria: No pink color is produced within 5 s.

- **Loss on Drying ⟨731⟩**

  Analysis: Dry at 105° for 3 h.

  Acceptance criteria: NMT 5.0%

ADDITIONAL REQUIREMENTS

- **Packaging and Storage:** Preserve in tight containers.
- **USP Reference Standards ⟨11⟩**

  USP Calcium Pantothenate RS

  USP Pantolactone RS

  USP Sodium D-Pantoate RS

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

Topic/Question	Contact	Expert Committee
CALCIUM PANTOTHENATE	Natalia Davydova Scientific Liaison	NBDS2020 Non-botanical Dietary Supplements

Chromatographic Database Information: Chromatographic Database

Most Recently Appeared In:
Pharmacopeial Forum: Volume No. 48(3)

Current DocID: GUID-2ABC90FA-F72D-4CD8-A2CF-90C09578D047_5_en-US

DOI: https://doi.org/10.31003/USPNF_M11910_05_01

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