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Powdered Turmeric

DEFINITION

Powdered Turmeric is Turmeric reduced to a fine or very fine powder. It contains NLT 3.0% of curcuminoids, calculated on the anhydrous basis.

IDENTIFICATION

• A. HPTLC FOR ARTICLES OF BOTANICAL ORIGIN (203)

Standard solution: 1 mg/mL of [USP Curcuminoids RS](#) in [methanol](#)

Sample solution: Suspend about 200 mg of Powdered Turmeric in 3 mL of [methanol](#), and sonicate for 10 min. Centrifuge or filter, and use the supernatant or the filtrate.

Chromatographic system

Adsorbent: Chromatographic silica gel with an average particle size of 5 µm (HPTLC plate)¹

Application volume: 2 µL each of the *Standard solution* and the *Sample solution* as 8-mm bands

Relative humidity: Condition the plate to a relative humidity of 33%.

Temperature: Ambient, not to exceed 30°

Developing solvent system: [Toluene](#) and glacial acetic acid (4:1)

Developing distance: 6 cm

Derivatization reagent: 85 mL of ice-cold [methanol](#) combined with 10 mL of glacial acetic acid, 5 mL of [sulfuric acid](#), and 0.5 mL of [p-anisaldehyde](#)

Analysis

Samples: *Standard solution* and *Sample solution*

Apply the *Samples* as bands and dry in air. Develop in a saturated chamber and dry in air. Treat with *Derivatization reagent*, heat at 100° for 3 min, and examine under long-wave UV light (365 nm) and under white light.

System suitability: Under long-wave UV light (365 nm), the derivatized chromatogram of the *Standard solution* exhibits, in its lower half, three bands in the order of increasing R_f : an orange band due to bisdesmethoxycurcumin, an orange band due to desmethoxycurcumin, and the red band due to curcumin. Under white light, the two lower bands appear orange, while the topmost band is reddish-pink.

Acceptance criteria: Under long-wave UV light (365 nm), the derivatized chromatogram of the *Sample solution* displays two orange bands and one red band, similar in position and color to those observed in the *Standard solution*. At the bottom part of the upper half of the plate, two purple bands are seen. Under white light, two orange bands and a darker red band are seen coincident with the bands due to bisdesmethoxycurcumin, desmethoxycurcumin, and curcumin in the *Standard solution*, in the order of increasing R_f . In the upper half of the plate, the lower of the two bands appears purple, while the upper band is brown. No bands appear in the topmost quarter of the plate, which is characteristic of *Curcuma zanthorrhiza* Roxb. and *Curcuma aromatica* Salisb. These confounders, and occasional adulterants, of Powdered Turmeric also lack the lower orange band corresponding to bisdesmethoxycurcumin. Additional weak bands may be observed in the *Sample solution* under either illumination condition.

• B. HPLC

Analysis: Proceed as directed in the test for *Content of Curcuminoids*.

Acceptance criteria: The retention times of the peaks for curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin of the *Sample solution* correspond to those of *Standard solution A* and *Standard solution B*.

COMPOSITION

• CONTENT OF CURCUMINOIDS

Mobile phase: [Tetrahydrofuran](#) and 1 mg/mL of [citric acid](#) in water (4:6)

Standard solution A: 40 µg/mL of [USP Curcuminoids RS](#) in *Mobile phase*

Standard solution B: A composite solution containing 40 µg/mL of [USP Curcumin RS](#), 10 µg/mL of [USP Desmethoxycurcumin RS](#), and 2.0 µg/mL of [USP Bisdesmethoxycurcumin RS](#) in *Mobile phase*. Use sonication if necessary. Before injection, pass through a filter of 0.45-µm pore size, and discard the initial 10 mL of the filtrate.

Sample stock solution: Transfer about 0.5 g of Powdered Turmeric, accurately weighed, to a 50-mL volumetric flask, add 30 mL of [acetone](#), and sonicate for 30 min. Dilute with [acetone](#) to volume, mix, and centrifuge.

Sample solution: Transfer 5.0 mL of the *Sample stock solution* to a 50-mL volumetric flask. Dilute with *Mobile phase* to volume, and mix.

Before injection, pass through a filter of 0.45-μm pore size, and discard the initial 10 mL of the filtrate.

Chromatographic system

(See [Chromatography \(621\)](#), [System Suitability](#).)

Mode: LC

Detector: Vis 420 nm

Column: 4.6-mm × 25-cm; 5-μm packing L1

Flow rate: 1.0 mL/min

Injection volume: 20 μL

System suitability

Samples: *Standard solution A* and *Standard solution B*

[NOTE—The relative retention times for the curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin peaks are 1.0, 1.2, and 1.4, respectively.]

Suitability requirements

Chromatogram similarity: The chromatogram of *Standard solution A* is similar to the reference chromatogram provided with [USP Curcuminoids RS](#).

Resolution: NLT 2.0 between curcumin and desmethoxycurcumin peaks and desmethoxycurcumin and bisdesmethoxycurcumin peaks, *Standard solution B*

Tailing factor: NMT 1.5 for bisdesmethoxycurcumin, desmethoxycurcumin, and curcumin peaks, *Standard solution B*

Relative standard deviation: NMT 2.0% for the desmethoxycurcumin peak, in replicate injections, *Standard solution B*

Analysis

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

Calculate the percentages of curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin in the portion of Powdered Turmeric taken:

$$\text{Result} = (r_U/r_S) \times C_S \times (V/W) \times D \times 100$$

r_U = peak area of the relevant analyte from the *Sample solution*

r_S = peak area of the relevant analyte from *Standard solution B*

C_S = concentration of the relevant analyte in *Standard solution B* (mg/mL)

V = volume of the *Sample stock solution* (mL)

W = weight of Powdered Turmeric used to prepare the *Sample stock solution* (mg)

D = dilution factor to obtain the *Sample solution* from the *Sample stock solution*, 10

Acceptance criteria: NLT 3.0% as the sum of curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin on the anhydrous basis

CONTAMINANTS

- [ARTICLES OF BOTANICAL ORIGIN \(561\)](#), [Limits of Elemental Impurities](#): Meets the requirements
- [ARTICLES OF BOTANICAL ORIGIN \(561\)](#), [Pesticide Residue Analysis](#): Meets the requirements
- [ARTICLES OF BOTANICAL ORIGIN \(561\)](#), [Test for Aflatoxins](#): Meets the requirements
- [MICROBIAL ENUMERATION TESTS \(2021\)](#): The total aerobic bacterial count does not exceed 10^5 cfu/g, the total combined molds and yeasts count does not exceed 10^3 cfu/g, and the bile-tolerant Gram-negative bacterial count does not exceed 10^3 cfu/g.
- [ABSENCE OF SPECIFIED MICROORGANISMS \(2022\)](#), [Test Procedures](#), [Test for Absence of Salmonella Species](#) and [Test for Absence of Escherichia coli](#): Meets the requirements

SPECIFIC TESTS

- **BOTANICAL CHARACTERISTICS:** Powdered Turmeric is deep yellow in color with a characteristic aromatic odor. Under a microscope, Powdered Turmeric reveals thin-walled parenchyma cells containing starch granules, 15–30 μm in size, flat or disk-shaped, gelatinized or ungelatinized; oil cells full of oil and scattered particles of orange-yellow pigments; prisms of calcium oxalate, usually obscured due to the bright yellow color of the pigment content, detected as bright orange prisms under a polarizing microscope; fragments of spiral vessels and a few reticulate and annular vessels; fragments of epidermal and cork cells; starch granules; scattered unicellular nonglandular trichomes; and the absence of bast fibers.
- [ARTICLES OF BOTANICAL ORIGIN \(561\)](#), [Methods of Analysis](#), [Volatile Oil Determination](#): NLT 3.0 mL/100 g