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Ginger

DEFINITION

Ginger is the dried rhizome of *Zingiber officinale* Roscoe (Fam. Zingiberaceae), scraped, partially scraped, or unscraped. It is known in commerce as unbleached ginger.

IDENTIFICATION

• A.

Analysis: Pulverize 5 g of Ginger. To 1 g of the pulverized Ginger add 5 mL of dilute acetic acid, prepared by diluting 1 part of glacial acetic acid with 1 part of water, and shake for 15 min. Filter, and add a few drops of ammonium oxalate TS to the filtrate.

Acceptance criteria: NMT a slight turbidity is produced.

• B.

Sample: 50 mg of the residue obtained in the test for *Articles of Botanical Origin, Alcohol-Soluble Extractives, Method 2*

Analysis: Dissolve the *Sample* in 25 mL of water, and extract this solution with two 15-mL portions of ether. Combine the ether extracts, and evaporate in a porcelain dish. To the residue add 5 mL of sulfuric acid solution (7.5 in 10.0) and 5 mg of vanillin. Allow to stand for 15 min, and add an equal volume of water.

Acceptance criteria: The solution turns azure blue.

• C. [HPTLC FOR ARTICLES OF BOTANICAL ORIGIN \(203\)](#)

Standard solution A: 0.2 mg/mL of [USP Ginger Constituent Mixture RS](#) in methanol

Standard solution B: 100 mg/mL of [USP Powdered Ginger RS](#) in methanol. Sonicate for 10 min, and centrifuge or filter. Use supernatant or filtrate.

Sample solution: Pulverize 5 g of Ginger. Prepare a 100-mg/mL dispersion of Ginger in methanol. Sonicate for 10 min, and centrifuge or filter. Use supernatant or filtrate.

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

Application volume: 6 µL of *Standard solution A* and 2 µL each of *Standard solution B* and *Sample solution* as 8-mm bands

Temperature: Ambient, not to exceed 30°

Developing solvent system: Toluene and ethyl acetate (3:1)

Derivatization reagent: To 170 mL of ice-cold methanol add 20 mL of glacial acetic acid, 10 mL of sulfuric acid, and 1 mL of anisaldehyde. Mix well.

System suitability

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

Apply the *Samples* and dry in air. Condition at relative humidity of about 33%. Develop in a saturated chamber until the solvent front has migrated over a path of 6 cm. Dry in a current of cold air, and immerse into *Derivatization reagent* for 1 s. Heat for 3 min at 100°, and examine under white light and under long-wave UV (365 nm).

Suitability requirements

Chromatographic pattern: Under white light, the derivatized chromatogram of *Standard solution A* displays two prominent bands: the lower due to 6-gingerol, the upper due to 6-shogaol. Under white light, the derivatized chromatogram of *Standard solution B* shows a succession of dark-violet bands between the origin and the intense dark-brown band corresponding to that of the 6-gingerol in *Standard solution A*. Immediately proximate to the 6-gingerol band in the *Standard solution B* chromatogram, less intense bands due to 8-gingerol and 10-gingerol are observed. A variable number of low-intensity dark-gray bands appear between 10-gingerol and the second prominent band corresponding to 6-shogaol in *Standard solution A*. In the distal part of the chromatogram, a dark-purple somewhat diffuse band is observed. Under long-wave UV (365 nm), the chromatograms of the *Standard solutions* exhibit patterns similar to those observed under white light. The bands due to gingerols and shogaols are bright orange; the bands between the origin and the 6-gingerol band are dark-red to brown, somewhat less prominent than when observed in white light. The bands between 10-gingerol and 6-shogaol are variably colored; frequently, a light-gray band appears halfway between them, with a light-purple diffuse band between it and the orange band due to 6-shogaol. The distal diffuse band assumes a purple-pink hue.

Analysis

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

Treat and examine the *Samples* as described under *System suitability*.

Acceptance criteria: Under white light and under long-wave UV (365 nm), the chromatogram of the *Sample solution* exhibits the band pattern similar to that observed with *Standard solution B*. The band in the distal part of the chromatogram, however, has no diagnostic significance. Its color may range from purple-pink to muddy yellow, or the band may be altogether absent. Potential adulterants lack the band pattern characteristic of the gingerol–shogaol succession. *Kaempferia galanga* L. rhizome shows no diagnostic bands under UV, but under white light a purple band is seen at about two-thirds from the application line. Lesser galangal (*Alpinia officinarum* Hance) rhizome presents a yellow band at an R_F just below the 6-gingerol band, followed by a continuous broad blue smudge, and a distinct tandem of light-orange and yellow bands close to the middle of the plate.

COMPOSITION

• CONTENT OF GINGEROLS AND GINGERDIONES

Solution A: Acetonitrile, dilute phosphoric acid (1 in 1000), and methanol (55:44:1)

Solution B: Acetonitrile

Mobile phase: Use *Solution A* for NLT 7 times the retention time of capsaicin.

Column washing: After each chromatographic run, wash the column, using [Table 1](#).

Table 1

Time (min)	Solution A (%)	Solution B (%)
0	100	0
2	0	100
12	0	100
14	100	0
29	100	0

Standard solution: 0.1 mg/mL of [USP Capsaicin RS](#) in methanol

System suitability solution: Reconstitute the content of one vial of [USP Ginger Constituent Mixture RS](#) in 1 mL of the *Standard solution*.

Sample solution: Use the filtrate retained from the test for *Articles of Botanical Origin, Alcohol-Soluble Extractives, Method 2*.

Chromatographic system

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

Mode: LC

Detector: UV 282 nm

Column: 4.6-mm × 25-cm; packing L1

Flow rate: 1 mL/min

Injection volume: 25 µL

System suitability

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

[NOTE—The relative retention times for 6-gingerol, capsaicin, and 6-shogaol are about 0.8, 1.0, and 1.9, respectively, *System suitability solution*.]

Suitability requirements

Resolution: NLT 3.0 between the 6-gingerol and capsaicin peaks; NLT 10.0 between the capsaicin and 6-shogaol peaks, *System suitability solution*

Tailing factor: NMT 2.0 for the 6-gingerol, capsaicin, and 6-shogaol peaks, *System suitability solution*

Relative standard deviation: NMT 2.5%, *Standard solution*

Analysis

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

Calculate the sum of the peak responses due to gingerols and gingerdiones occurring at about the following retention times, relative to 1.0 for capsaicin: 0.8 for 6-gingerol, 1.5 for 8-gingerol A, 2.2 for 8-gingerol B, 2.5 for 6-gingerdiol, 2.6 for 6-gingerdione, 3.4 for 10-gingerol, and 5.2 for 8-gingerdione.

Calculate the percentage of gingerols and gingerdiones in the portion of Ginger taken: