

Status: Currently Official on 14-Feb-2025
 Official Date: Official as of 01-Aug-2023
 Document Type: USP Monographs
 DocId: GUID-3EE8EFDA-BFB3-442E-A4E1-BE5A85A46CDC_2_en-US
 DOI: https://doi.org/10.31003/USPNF_M29220_02_01
 DOI Ref: ei3vk

© 2025 USPC
 Do not distribute

Enalapril Maleate and Hydrochlorothiazide Tablets

DEFINITION

Enalapril Maleate and Hydrochlorothiazide Tablets contain NLT 90.0% and NMT 110.0% of the labeled amounts of enalapril maleate ($C_{20}H_{28}N_2O_5 \cdot C_4H_4O_4$) and hydrochlorothiazide ($C_7H_8ClN_3O_4S_2$).

IDENTIFICATION

- **A.** The retention time of the major peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the Assay for *Enalapril Maleate*.
- **B.** The retention time of the major peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the Assay for *Hydrochlorothiazide*.

ASSAY

• ENALAPRIL MALEATE

Buffer: 136 mg/L of monobasic potassium phosphate in water. Initially add water to 80% of the total volume, adjust with phosphoric acid to a pH of 2.0, and dilute with water to volume. Adjust the pH before makeup to final volume.

Mobile phase: Acetonitrile and *Buffer* (400:600)

Standard solution: 0.2 mg/mL of [USP Enalapril Maleate RS](#) prepared as follows. Dissolve a suitable amount of [USP Enalapril Maleate RS](#) in about 25% of the total volume with methanol, and dilute to volume with *Buffer*.

Sample solution: Transfer a portion of the powder from NLT 20 Tablets, equivalent to 40 mg of enalapril maleate, to a 200-mL volumetric flask. Add 50 mL of *Buffer*, and sonicate for 15 min. Add 50 mL of methanol, sonicate for an additional 15 min, dilute with *Buffer* to volume, and filter.

Chromatographic system

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

Mode: LC

Detector: UV 215 nm

Column: 4.6-mm × 25-cm; 5-μm packing L7

Column temperature: 65°

Flow rate: 1.5 mL/min

Injection volume: 50 μL

System suitability

Sample: *Standard solution*

Suitability requirements

Column efficiency: NLT 700 theoretical plates

Tailing factor: NMT 3.5

Relative standard deviation: NMT 2.0%

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of the labeled amount of enalapril maleate ($C_{20}H_{28}N_2O_5 \cdot C_4H_4O_4$) in the portion of Tablets taken:

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

r_U = peak response of enalapril from the *Sample solution*

r_S = peak response of enalapril from the *Standard solution*

C_S = concentration of [USP Enalapril Maleate RS](#) in the *Standard solution* (mg/mL)

C_U = nominal concentration of enalapril maleate in the *Sample solution* (mg/mL)

Acceptance criteria: 90.0%–110.0%

• HYDROCHLOROTHIAZIDE

Buffer: Prepare as directed in the Assay for *Enalapril Maleate*.

Mobile phase: Acetonitrile and *Buffer* (100:900)

Standard solution: 0.1 mg/mL of [USP Hydrochlorothiazide RS](#) prepared as follows. Dissolve a suitable quantity of [USP Hydrochlorothiazide RS](#) in 25% of the total volume of methanol, and dilute with *Buffer* to volume.

Sample solution: Transfer a portion of the powder from NLT 20 Tablets, equivalent to 20 mg of hydrochlorothiazide, to a 200-mL volumetric flask. Add 50 mL of *Buffer*, and sonicate for 15 min. Add 50 mL of methanol, sonicate for an additional 15 min, dilute with *Buffer* to volume, and filter.

Chromatographic system

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

Mode: LC

Detector: UV 310 nm

Column: 4.6-mm × 20-cm; 10-μm packing L7

Column temperature: 30°

Flow rate: 2.5 mL/min

Injection volume: 50 μL

System suitability

Sample: *Standard solution*

Suitability requirements

Column efficiency: NLT 1000 theoretical plates

Tailing factor: NMT 2.0

Capacity factor, k': NLT 2.0

Relative standard deviation: NMT 2.0%

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of the labeled amount of hydrochlorothiazide ($C_7H_8ClN_3O_4S_2$) in the portion of Tablets taken:

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

r_U = peak response of hydrochlorothiazide from the *Sample solution*

r_S = peak response of hydrochlorothiazide from the *Standard solution*

C_S = concentration of [USP Hydrochlorothiazide RS](#) in the *Standard solution* (mg/mL)

C_U = nominal concentration of hydrochlorothiazide in the *Sample solution* (mg/mL)

Acceptance criteria: 90.0%–110.0%

PERFORMANCE TESTS

• [DISSOLUTION \(711\)](#)

Enalapril maleate

Medium: Water; 900 mL

Apparatus 2: 50 rpm

Time: 30 min

Standard solution: [USP Enalapril Maleate RS](#) in *Medium*

Sample solution: Sample per [Dissolution \(711\)](#). Dilute with *Medium* to a concentration similar to that of the *Standard solution*.

Analysis: Determine the percentage of the labeled amount of enalapril maleate ($C_{20}H_{28}N_2O_5 \cdot C_4H_4O_4$) dissolved, using the test for

Uniformity of Dosage Units, Procedure for content uniformity of enalapril maleate.

Hydrochlorothiazide

Medium: Water; 900 mL

Apparatus 2: 50 rpm

Time: 30 min

Detector: UV 320 and 360 nm

Cell size: 1 cm

Standard solution: [USP Hydrochlorothiazide RS](#) dissolved in 20 mL of methanol and diluted with *Medium*

Sample solution: Sample per [Dissolution \(711\)](#). Dilute with *Medium* to a concentration that is similar to that of the *Standard solution*.

Analysis

Samples: *Standard solution* and *Sample solution*

Calculate the percentage of hydrochlorothiazide ($C_7H_8ClN_3O_4S_2$) dissolved:

$$\text{Result} = (A_U/A_S) \times (C_S/L) \times V \times D \times 100$$

A_U = difference in absorbances ($A_{320} - A_{360}$) at the wavelengths indicated for the *Sample solution*

A_S = difference in absorbances ($A_{320} - A_{360}$) at the wavelengths indicated for the *Standard solution*

