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# Potassium Citrate and Citric Acid Oral Solution

## DEFINITION

Potassium Citrate and Citric Acid Oral Solution is a solution of Potassium Citrate and Citric Acid in a suitable aqueous medium. In each 100 mL, it contains NLT 7.55 g and NMT 8.35 g of potassium (K), and NLT 12.18 g and NMT 13.46 g of citrate ($C_6H_5O_7$), equivalent to NLT 20.9 g and NMT 23.1 g of potassium citrate monohydrate ($C_6H_5K_3O_7 \cdot H_2O$). It also contains NLT 6.34 g and NMT 7.02 g of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$).

[NOTE—The potassium ion content of Oral Solution is approximately 2 mEq/mL.]

## IDENTIFICATION

***Change to read:***

• **A. ▲POTASSIUM:** The retention time of the potassium peak of the *Sample solution* corresponds to that of the *Standard solution*, as obtained in the *Assay, Procedure 1: Potassium*.▲ (USP 1-Aug-2022)

• **B.**

**Sample solution:** Oral Solution and hydrochloric acid (50:50)

**Analysis:** To 2 mL of the *Sample solution* add 10 mL of cobalt–uranyl acetate TS, and stir with a glass rod.

**Acceptance criteria:** No precipitate or turbidity forms after 15 min, and the *Sample solution* remains clear (absence of sodium).

***Change to read:***

• **C. ▲CITRATE:** The retention time of the citrate peak of the *Sample solution* corresponds to that of *Standard solution 1*, as obtained in the *Assay, Procedure 2: Citrate*.▲ (USP 1-Aug-2022)

## ASSAY

***Change to read:***

• **▲PROCEDURE 1:▲** (USP 1-AUG-2022) **POTASSIUM**

▲Use water with a resistivity of NLT 18 megohm-cm to prepare the solutions.

**Mobile phase:** 4 mM nitric acid

**System suitability solution:** 40 µg/mL of USP Potassium Citrate RS and 15 µg/mL of magnesium[1] in water

**Standard solution:** 40 µg/mL of USP Potassium Citrate RS in water

**Sample stock solution:** Nominally 2 mg/mL of potassium citrate monohydrate prepared as follows. Transfer a suitable aliquot of Oral Solution to a suitable volumetric flask, and dilute with water to volume.

**Sample solution:** Nominally 40 µg/mL of potassium citrate monohydrate in water from the *Sample stock solution*

**Chromatographic system**

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

**Mode:** LC

**Detector:** Direct conductivity

**Columns**

**Guard:** 4-mm × 0.5-cm; 5-µm packing L76

**Analytical:** 4-mm × 15-cm; 5-µm packing L76

**Column temperature:** 30°

**Flow rate:** 0.9 mL/min

**Injection volume:** 20 µL

**Run time:** NLT 2 times the retention time of the potassium peak

**System suitability**

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

[NOTE—The relative retention times for the potassium and magnesium ions are 1.0 and 1.3, respectively.]

**Suitability requirements**

**Resolution:** NLT 3.0 between the potassium and magnesium ions, *System suitability solution*

**Tailing factor:** NMT 2.0, *Standard solution*

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

**Analysis**

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

Calculate the quantity, in g, of potassium (K) in each 100 mL of Oral Solution taken:

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

$r_U$ = peak response of potassium from the *Sample solution*

$r_S$ = peak response of potassium from the *Standard solution*

$C_S$ = concentration of USP Potassium Citrate RS in the *Standard solution* (µg/mL)

$C_U$ = nominal concentration of potassium citrate monohydrate in the *Sample solution* (µg/mL)

$L$ = label claim of potassium for Oral Solution (g/100 mL)▲ (USP 1-Aug-2022)

**Acceptance criteria:** 7.55–8.35 g of potassium (K) in each 100 mL

***Change to read:***

• **▲Procedure 2:▲ (USP 1-Aug-2022) Citrate**

**Mobile phase, Standard ▲solution▲ (USP 1-Aug-2022) 1,** and **Chromatographic system:** Proceed as directed in the *Assay for Citric Acid/Citrate and Phosphate* ⟨345⟩.

**Sample solution:** Transfer 15 mL of Oral Solution to a suitable volumetric flask, and proceed as directed in the *Sample solution (for the assay of citric acid/citrate)* in ⟨345⟩.

**Analysis**

**Samples:** *Standard ▲solution▲ (USP 1-Aug-2022) 1* and *Sample solution*

▲▲ (USP 1-Aug-2022)

Calculate the quantity, in g, of citrate ($C_6H_5O_7$) in each 100 mL of Oral Solution taken:

$$\text{Result} = \{[(r_U/r_S) \times (C_S/F) \times D] - A \times (M_{r1}/M_{r2})\} \times {}^{\blacktriangle}V_{\blacktriangle}\ \text{(USP 1-Aug-2022)}$$

$r_U$ = peak response of citrate from the *Sample solution*

$r_S$ = peak response of citrate from *Standard ▲solution▲ (USP 1-Aug-2022) 1*

$C_S$ = concentration of citrate in *Standard ▲solution▲ (USP 1-Aug-2022) 1* (µg/mL)

$F$ = conversion factor, $10^6$ µg/g

$D$ = dilution factor for the *Sample solution*

$A$ = ▲concentration▲ (USP 1-Aug-2022) of citric acid monohydrate in the Oral Solution determined in ▲*Assay, Procedure 3: Citric Acid*▲ (USP 1-Aug-2022) (g/mL)

$M_{r1}$ = molecular weight of citrate, 189.10

$M_{r2}$ = molecular weight of citric acid monohydrate, 210.14

$^{\blacktriangle}V_{\blacktriangle}$ = volume of Oral Solution, 100 mL▲ (USP 1-Aug-2022)

**Acceptance criteria:** 12.18–13.46 g of citrate ($C_6H_5O_7$), equivalent to 20.9–23.1 g of potassium citrate monohydrate ($C_6H_5K_3O_7 \cdot H_2O$) and 6.34–7.02 g of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$), in each 100 mL

***Change to read:***

• ▲**Procedure 3:**▲ (USP 1-Aug-2022) **Citric Acid**

**Sample solution:** 15 mL of Oral Solution, dilute with water to 250 mL

**Titrimetric system**

**Mode:** Direct titration

**Titrant:** 0.02 N sodium hydroxide VS

**Endpoint detection:** Visual

**Analysis**

**Sample:** *Sample solution*

Transfer 5 mL of the *Sample solution* to a suitable flask. Add 25 mL of water and 5 drops of phenolphthalein TS. Titrate with *Titrant* to a pink endpoint. Record the buret reading, and calculate the volume of *Titrant* consumed. Each milliliter of *Titrant* is equivalent to 1.401 mg of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$).

**Acceptance criteria:** 6.34–7.02 g of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$) in each 100 mL of Oral Solution

## SPECIFIC TESTS

• **pH** ⟨791⟩**:** 4.9–5.4

## ADDITIONAL REQUIREMENTS

***Change to read:***

• **Packaging and Storage:** Preserve in tight containers. ▲Store at controlled room temperature.▲ (USP 1-Aug-2022)

***Add the following:***

▲• **USP Reference Standards** ⟨11⟩

USP Potassium Citrate RS▲ (USP 1-Aug-2022)

[1] From commercially available National Institute of Standards and Technology (NIST)-traceable standard solution for magnesium.

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

| Topic/Question | Contact | Expert Committee |
|---|---|---|
| POTASSIUM CITRATE AND CITRIC ACID ORAL SOLUTION | Documentary Standards Support | SM52020 Small Molecules 5 |
| REFERENCE STANDARD SUPPORT | RS Technical Services<br>RSTECH@usp.org | SM52020 Small Molecules 5 |

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