

Potassium Citrate

1 Nonproprietary Names

BP: Potassium citrate
PhEur: Kalii citras
USP: Potassium citrate

2 Synonyms

Citrate of potash; citric acid potassium salt; E332; tripotassium citrate monohydrate.

3 Chemical Name and CAS Registry Number

2-Hydroxy-1,2,3-propanetricarboxylic acid tripotassium salt monohydrate [6100-05-6]
2-Hydroxy-1,2,3-propanetricarboxylic acid tripotassium salt anhydrous [866-84-2]

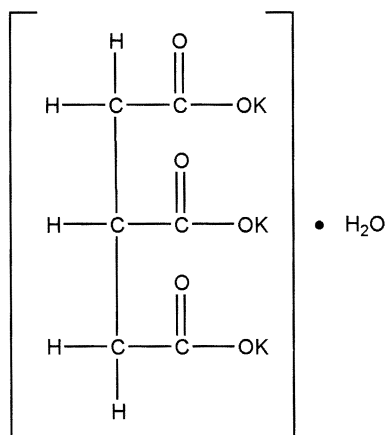
4 Empirical Formula

$C_6H_5K_3O_7 \cdot H_2O$
 $C_6H_5K_3O_7$

Molecular Weight

324.41 (for monohydrate)
306.40 (for anhydrous)

5 Structural Formula



6 Functional Category

Alkalizing agent; buffering agent; sequestering agent.

7 Applications in Pharmaceutical Formulation or Technology

Potassium citrate is used in beverages, foods, and oral pharmaceutical formulations as a buffering and alkalizing agent. It is also used as a sequestering agent and as a therapeutic agent to alkalinize the urine and to relieve the painful irritation caused by cystitis.⁽¹⁻⁵⁾ See Table I.

Table I: Uses of potassium citrate.

Use	Concentration (%)
Buffer for solutions	0.3–2.0
Sequestering agent	0.3–2.0

8 Description

Transparent prismatic crystals or a white, granular powder. Potassium citrate is hygroscopic and odorless, and has a cooling, saline taste.

9 Pharmacopeial Specifications

See Table II.

Table II: Pharmacopeial specifications for potassium citrate.

Test	PhEur 2002	USP 25
Identification	+	+
Acidity or alkalinity	+	+
Loss on drying	4.0–7.0%	3.0–6.0%
Appearance of solution	+	—
Tartrate	—	+
Heavy metals	≤ 10 ppm	≤ 0.001%
Sodium	≤ 0.3%	—
Chlorides	≤ 50 ppm	—
Oxalates	≤ 300 ppm	—
Sulfates	≤ 150 ppm	—
Organic volatile impurities	—	+
Readily carbonizable substances	+	—
Assay (dried basis)	99.0–101.0%	99.0–100.5%

10 Typical Properties

Acidity/alkalinity: pH = 8.5 (saturated aqueous solution).

Density: 1.98 g/cm³

Melting point: 230 °C (loses water of crystallization at 180 °C).

Solubility: see Table III.

Table III: Solubility of potassium citrate.

Solvent	Solubility at 20 °C
Ethanol (95%)	Practically insoluble
Glycerin	1 in 2.5
Water	1 in 0.65

11 Stability and Storage Conditions

Potassium citrate is a stable, though hygroscopic material, and should be stored in an airtight container in a cool, dry place.

12 Incompatibilities

Aqueous potassium citrate solutions are slightly alkaline and will react with acidic substances. Potassium citrate may also precipitate alkaloidal salts from their aqueous or alcoholic solutions. Calcium and strontium salts will cause precipitation of the corresponding citrates.

13 Method of Manufacture

Potassium citrate is prepared by adding either potassium bicarbonate or potassium carbonate to a solution of citric acid until effervescence ceases. The resulting solution is then filtered and evaporated to dryness to obtain potassium citrate.

14 Safety

Potassium citrate is used in oral pharmaceutical formulations and is generally regarded as a nontoxic and nonirritant material by this route of administration.

Most potassium citrate safety data relate to its use as a therapeutic agent, for which up to 10 g may be administered daily, in divided doses, as a treatment for cystitis. Although there are adverse effects associated with excessive ingestion of potassium salts, the quantities of potassium citrate used as a pharmaceutical excipient are insignificant in comparison to those used therapeutically.

LD₅₀ (IV, dog): 0.17 g/kg⁽⁶⁾

15 Handling Precautions

Observe normal precautions appropriate to the circumstances and quantity of material handled. Potassium citrate may be irritant to the skin and eyes and should be handled in a well-ventilated environment. Eye protection and gloves are recommended. When heated to decomposition, potassium citrate emits toxic fumes of potassium oxide.⁽⁶⁾

16 Regulatory Status

GRAS listed. Accepted as a food additive in Europe. Included in the FDA Inactive Ingredients Guide (oral solutions). Included in nonparenteral medicines licensed in the UK.

17 Related Substances

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18 Comments

Each gram of potassium citrate monohydrate represents approximately 9.25 mmol of potassium and 3.08 mmol of citrate. Each gram of potassium citrate anhydrous represents approximately 9.79 mmol of potassium and 3.26 mmol of citrate. The EINECS number for potassium citrate is 212-755-5.

19 Specific References

- 1 Elizabeth JE, Carter NJ. Potassium citrate mixture: soothing but not harmless? *Br Med J* 1987; 295: 993.
- 2 Gabriel R. Potassium sorbate mixture: soothing but not harmless? [letter] *Br Med J* 1987; 295: 1487.
- 3 Liak TL, Li Wan Po A, Irwin WJ. The effects of drug therapy on urinary pH: excipient effects and bioactivation of methenamine. *Int J Pharm* 1987; 36: 233-242.
- 4 Fjellstedt E, Denneberg T, Jeppsson JO, Tiselins HG. A comparison of the effects of potassium citrate and sodium bicarbonate in the alkalization of urine in homozygous cystinuria. *Urol Res* 2001; 29(5): 295-302.
- 5 Domrongkitchaiporn S, Khositseth S, Stitchantrokul W, *et al.* Dosage of potassium citrate in the correction of urinary abnormalities in pediatric distal renal tubular acidosis patients. *Am J Kidney Dis* 2002; 39(2): 383-391.
- 6 Lewis RJ, ed. *Sax's Dangerous Properties of Industrial Materials*, 10th edn. New York: Wiley, 2000: 3025.

20 General References

Cole ET, Rees JE, Hersey JA. Relations between compaction data for some crystalline pharmaceutical materials. *Pharm Acta Helv* 1975; 50: 28-32.

21 Author

SC Owen.

22 Date of Revision

8 May 2002.