

Tartaric Acid

1 Nonproprietary Names

BP: Tartaric acid
JP: Tartaric acid
PhEur: Acidum tartaricum
USPNF: Tartaric acid

2 Synonyms

L-(+)-2,3-Dihydroxybutanedioic acid; (2*R*,3*R*)-2,3-dihydroxybutane-1,4-dioic acid; 2,3-dihydroxysuccinic acid; E334; *d*-tartaric acid; L-(+)-tartaric acid.

3 Chemical Name and CAS Registry Number

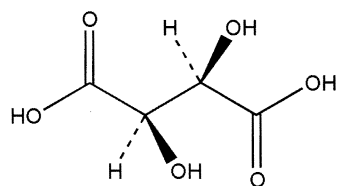
[*R*-(*R**,*R**)]-2,3-Dihydroxybutanedioic acid [87-69-4]

4 Empirical Formula Molecular Weight

C₄H₆O₆

150.09

5 Structural Formula



6 Functional Category

Acidifying agent; acidulant; flavor enhancer; sequestering agent.

7 Applications in Pharmaceutical Formulation or Technology

Tartaric acid is used in beverages, confectionery, food products, and pharmaceutical formulations as an acidulant. It may also be used as an acidifying agent, as a sequestering agent, and as an antioxidant synergist. In pharmaceutical formulations, it is widely used in combination with bicarbonates, as the acid component of effervescent granules, powders, and tablets.

8 Description

Tartaric acid occurs as colorless monoclinic crystals, or a white or almost white crystalline powder. It is odorless, with an extremely tart taste.

9 Pharmacopeial Specifications

See Table I.

Table I: Pharmacopeial specifications for tartaric acid.

| Test | JP 2001 | PhEur 2002 | USPNF 20 |
|-----------------------------|---------|------------------|------------------|
| Identification | + | + | + |
| Characters | — | + | — |
| Appearance of solution | — | + | — |
| Specific rotation | — | +12.0° to +12.8° | +12.0° to +13.0° |
| Loss on drying | ≤0.5% | ≤0.2% | ≤0.5% |
| Sulfated ash | — | ≤0.1% | — |
| Residue on ignition | ≤0.05% | — | ≤0.1% |
| Organic volatile impurities | — | — | + |
| Chloride | — | ≤100 ppm | — |
| Oxalic acid | — | ≤350 ppm | — |
| Oxalate | + | — | + |
| Sulfate | ≤0.048% | ≤150 ppm | + |
| Calcium | + | ≤200 ppm | — |
| Heavy metals | ≤10 ppm | ≤10 ppm | ≤0.001% |
| Arsenic | ≤1 ppm | — | — |
| Assay (dried basis) | ≥99.7% | 99.5–101.0% | 99.7–100.5% |

10 Typical Properties

Acidity/alkalinity: pH = 2.2 (1.5% w/v aqueous solution)

Density: 1.76 g/cm³

Dissociation constant:

p*K*_{a1} = 2.93 at 25°C

p*K*_{a2} = 4.23 at 25°C

Heat of combustion: 1151 kJ/mol (275.1 kcal/mol)

Melting point: 168–170°C

Osmolarity: a 3.9% w/v aqueous solution is isoosmotic with serum.

Solubility: see Table II.

Specific heat: 1.20 J/g (0.288 cal/g) at 20°C

Specific rotation [α]_D²⁰: +12.0° (20% w/v aqueous solution)

Table II: Solubility of tartaric acid.

| Solvent | Solubility at 20°C unless otherwise stated |
|---------------|--|
| Chloroform | Practically insoluble |
| Ethanol (95%) | 1 in 2.5 |
| Ether | 1 in 250 |
| Glycerin | Soluble |
| Methanol | 1 in 1.7 |
| Propan-1-ol | 1 in 10.5 |
| Water | 1 in 0.75 |
| | 1 in 0.5 at 100°C |

11 Stability and Storage Conditions

The bulk material is stable and should be stored in a well-closed container in a cool, dry place.

12 Incompatibilities

Tartaric acid is incompatible with silver and reacts with metal carbonates and bicarbonates (a property exploited in effervescent preparations).

13 Method of Manufacture

Tartaric acid occurs naturally in many fruits as the free acid or in combination with calcium, magnesium, and potassium.

Commercially, nearly all tartaric acid is manufactured from potassium tartrate (cream of tartar), a by-product of wine making. Potassium tartrate is treated with hydrochloric acid, followed by the addition of a calcium salt to produce insoluble calcium tartrate. This precipitate is then removed by filtration and reacted with 70% sulfuric acid to yield tartaric acid and calcium sulfate.

14 Safety

Tartaric acid is widely used in food products and oral, topical, and parenteral pharmaceutical formulations and is generally regarded as a nontoxic and nonirritant material. However, strong tartaric acid solutions are mildly irritant and if ingested undiluted may cause gastroenteritis.

An acceptable daily intake for L-(+)-tartaric acid has not been set by the WHO, although an acceptable daily intake of up to 30 mg/kg body-weight for monosodium L-(+)-tartrate has been established.⁽¹⁾

LD₅₀ (mouse, IV): 0.49 g/kg⁽²⁾

15 Handling Precautions

Observe normal precautions appropriate to the circumstances and quantity of material handled. Tartaric acid may be irritant to the eyes; eye protection and rubber or plastic gloves are recommended. When heated to decomposition, tartaric acid emits acrid smoke and fumes.

16 Regulatory Status

GRAS listed. Accepted as a food additive in Europe. Included in the FDA Inactive Ingredients Guide (IM and IV injections; oral solutions, syrups and tablets; rectal and vaginal preparations). Included in nonparenteral medicines licensed in the UK.

17 Related Substances

Citric acid monohydrate; fumaric acid; malic acid; D-(–)-tartaric acid; DL-(±)-tartaric acid.

D-(–)-Tartaric acid

Empirical formula: C₄H₆O₆

Molecular weight: 150.09

CAS number: [147-71-7]

Synonyms: [S-(R*,R*)]-2,3-dihydroxybutanedioic acid; *l*-tartaric acid.

Appearance: colorless monoclinic crystals, or white or almost white crystalline powder.

Density: 1.76 g/cm³

Dissociation constant:

pK_{a1} = 2.93

pK_{a2} = 4.23

Melting point: 168–170°C

Solubility: see Table III.

Table III: Solubility of D-(–)-tartaric acid.

| Solvent | Solubility at 20°C unless otherwise stated |
|---------------|--|
| Chloroform | Practically insoluble |
| Ethanol (95%) | 1 in 2.5 |
| Ether | 1 in 250 |
| Glycerin | Soluble |
| Methanol | 1 in 1.7 |
| Propan-1-ol | 1 in 0.5 |
| Water | 1 in 0.75 |
| | 1 in 0.5 at 100°C |

Specific rotation [α]_D²⁰: –12.0° (20% w/v aqueous solution)

Comments: prepared from DL-(±)-tartaric acid by treating with a variety of microorganisms, and from salt formation with *d*-methylamphetamine. It has also been found to occur naturally. The EINECS number for D-(–)-tartaric acid is 205-695-6.

DL-(±)-Tartaric acid

Empirical formula: C₄H₆O₆

Molecular weight: 150.09

CAS number: [133-37-9]

Synonyms: 2,3-dihydroxybutanedioic acid; racemic tartaric acid; *dl*-tartaric acid.

Appearance: colorless triclinic crystals, or white or almost white crystalline powder.

Acidity/alkalinity: pH = 2.0 (1.5% w/v aqueous solution)

Density: 1.70 g/cm³

Dissociation constant:

pK_{a1} = 2.96

pK_{a2} = 4.24

Melting point: 206°C

Solubility: 1 in 32 of ethanol (95%); 1 in 100 of ether; 1 in 4.85 of water.

Comments: not found in nature. Prepared by boiling L-(+)-tartaric acid in sodium hydroxide solution. The EINECS number for DL-(±)-tartaric acid is 205-105-7.

18 Comments

L-(+)-tartaric acid, the optical isomer usually encountered, is the naturally occurring form and is specified as tartaric acid in the PhEur 2002 and USPNF 20.

19 Specific References

- 1 FAO/WHO. Evaluation of certain food additives. Twenty-first report of the joint FAO/WHO expert committee on food additives. *World Health Organ Tech Rep Ser* 1978; No. 617.
- 2 Lewis RJ, ed. *Sax's Dangerous Properties of Industrial Materials*, 10th edn. New York: Wiley, 2000: 3349.

20 General References

- Sendall FEJ, Staniforth JN. A study of powder adhesion to metal surfaces during compression of effervescent pharmaceutical tablets. *J Pharm Pharmacol* 1986; 38: 489–493.
- Usui F, Carstensen JT. Interactions in the solid state I: interactions of sodium bicarbonate and tartaric acid under compressed conditions. *J Pharm Sci* 1985; 74: 1293–1297.

21 Author

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22 Date of Revision

9 October 2002.