

Calcium Glycerophosphate

Calcii glycerophosphas; Calcio, glicerofosfato de; Calcium Glycerinophosphate; Calcium, glycérophosphate de; Calcium Glycerylphosphate; Glycerofosforečnan vápenatý; Calcio glicerofosfata; Kalcium-glicerofoszfát; Kalciumglycerofosfat; Kalsiumglycerofosfaatti.

$C_3H_7CaO_6P(+xH_2O) = 210.1$ (anhydrous).

CAS — 27214-00-2 (anhydrous calcium glycerophosphate).

ATC — A12AA08.

ATC Vet — QA12AA08.

Pharmacopoeias. In *Eur.* (see p.vii), *US*, and *Viet.*

Ph. Eur. 6.2 (Calcium Glycerophosphate). A mixture in variable proportions of calcium (RS)-2,3-dihydroxypropyl phosphate and of calcium 2-hydroxy-1-(hydroxymethyl)ethyl phosphate, which may be hydrated. It contains not less than 18.6% and not more than 19.4% of calcium, calculated with reference to the dried substance. A white or almost white, hygroscopic powder. Sparingly soluble in water; practically insoluble in alcohol. It loses not more than 12% of its weight on drying.

USP 31 (Calcium Glycerophosphate). A mixture, in variable proportions, of calcium (RS)-2,3-dihydroxypropyl phosphate and calcium 2-hydroxy-1-(hydroxymethyl)ethyl phosphate, which may be hydrated. It contains not less than 18.6% and not more than 19.4% of calcium, calculated with reference to the dried substance. Store at a temperature between 20° and 25°, excursions permitted between 15° and 30°.

Equivalence. Each g of calcium glycerophosphate (anhydrous) represents about 4.8 mmol of calcium. Calcium glycerophosphate (anhydrous) 5.24 g is equivalent to about 1 g of calcium.

Calcium Hydrogen Phosphate

Calcii et Hydrogenii Phosphas; Calcii hydrogenophosphas; Calcio, hydrogenofosfato de; Calcium, hydrogénophosphate de; Calcium Hydrophosphoricum; Calcium Monohydrogen Phosphate; Dicalcium Orthophosphate; Dicalcium Phosphate; E341; Hydrogenfosforečnan vápenatý; Kalcio-vandenilio fosfatas; Kalcium-hidrogen-foszfát; Kalciumvátéfosfat; Kalsiumvetyfosfaatti; Wapna wodorofosforan. Calcium hydrogen orthophosphate.

$CaHPO_4 = 136.1$ (anhydrous); 172.1 (dihydrate).

CAS — 7757-93-9 (anhydrous calcium hydrogen phosphate); 7789-77-7 (calcium hydrogen phosphate dihydrate).

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Int.*, *Jpn.*, and *US*, which includes monographs for the anhydrous substance and the dihydrate form.

Ph. Eur. 6.2 (Calcium Hydrogen Phosphate, Anhydrous; Calcii Hydrogenophosphas Anhydricus). A white or almost white, crystalline powder, or colourless crystals. Practically insoluble in water and in alcohol; dissolves in dilute hydrochloric acid and in dilute nitric acid.

Ph. Eur. 6.2 (Calcium Hydrogen Phosphate Dihydrate; Calcii Hydrogenophosphas Dihydricus; Calcium Hydrogen Phosphate BP 2008). A white or almost white, crystalline powder. Practically insoluble in cold water and in alcohol; dissolves in dilute hydrochloric acid and in dilute nitric acid.

The BP 2008 gives Dibasic Calcium Phosphate as an approved synonym.

USP 31 (Anhydrous Dibasic Calcium Phosphate).

USP 31 (Dibasic Calcium Phosphate Dihydrate).

Equivalence. Each g of calcium hydrogen phosphate (dihydrate) represents about 5.8 mmol of calcium and of phosphate. Calcium hydrogen phosphate (dihydrate) 4.29 g is equivalent to about 1 g of calcium.

Calcium Lactate

Calcii lactas; Calcio, lactato de; Calcium, lactate de; E327; Kalcio laktatas; Kalciumlaktat; Kalcium-laktát; Kalsiumlakttaatti; Kalsiyum Laktat; Mléčnan vápenatý; Wapnia mleczan. Calcium 2-hydroxypropionate.

$C_6H_{10}CaO_6 \cdot xH_2O = 218.2$ (anhydrous); 308.3 (pentahydrate); 272.3 (trihydrate).

CAS — 814-80-2 (anhydrous calcium lactate); 41372-22-9 (hydrated calcium lactate); 5743-47-5 (calcium lactate pentahydrate); 63690-56-2 (calcium lactate pentahydrate).

ATC — A12AA05.

ATC Vet — QA12AA05.

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn.*, and *US*.

Eur. has separate monographs for the anhydrous substance, the monohydrate, the pentahydrate, and the trihydrate. *US* allows anhydrous or hydrous forms. *Viet.* has monographs for the pentahydrate and the trihydrate.

Ph. Eur. 6.2 (Calcium Lactate, Anhydrous; Calcii Lactas Anhydricus). A white or almost white, crystalline or granular powder. Soluble in water; freely soluble in boiling water; very slightly soluble in alcohol.

Ph. Eur. 6.2 (Calcium Lactate Monohydrate; Calcii Lactas Monohydricus). A white or almost white, crystalline or granular powder. Soluble in water; freely soluble in boiling water; very slightly soluble in alcohol.

Ph. Eur. 6.2 (Calcium Lactate Pentahydrate; Calcii Lactas Pentahydricus). A white or almost white, slightly efflorescent, crystalline or granular powder. Soluble in water; freely soluble in boiling water; very slightly soluble in alcohol.

The BP 2008 gives Calcium Lactate as an approved synonym.

Ph. Eur. 6.2 (Calcium Lactate Trihydrate; Calcii Lactas Trihydricus). A white or almost white, crystalline or granular powder. Soluble in water; freely soluble in boiling water; very slightly soluble in alcohol.

USP 31 (Calcium Lactate). White, practically odourless, granules or powder. The pentahydrate is somewhat efflorescent and at 120° becomes anhydrous. The pentahydrate is soluble 1 in 20 of water and practically insoluble in alcohol. Store in airtight containers.

Equivalence. Each g of calcium lactate (trihydrate) represents about 3.7 mmol of calcium. Each g of calcium lactate (pentahydrate) represents about 3.2 mmol of calcium. Calcium lactate (pentahydrate) 7.7 g and calcium lactate (trihydrate) 6.8 g are each equivalent to about 1 g of calcium.

Calcium Lactate Gluconate

Calcio, gluconato lactato de.

$Ca_2(C_3H_5O_3)_6 \cdot (C_6H_{11}O_7)_4 \cdot 2H_2O = 1551.4$.

ATC — A12AA06.

ATC Vet — QA12AA06.

Equivalence. Each g of calcium lactate gluconate (dihydrate) represents about 3.2 mmol of calcium. Calcium lactate gluconate (dihydrate) 7.74 g is equivalent to about 1 g of calcium.

Calcium Lactobionate

Calcii Lactobionas; Calcio, lactobionato de; Calcium Lactobionate Dihydrate; Kalciumlaktobionat; Kalsiumlaktobionaatti. Calcium 4-O-β-D-galactopyranosyl-D-gluconate dihydrate.

$C_{24}H_{42}CaO_{24} \cdot 2H_2O = 790.7$.

CAS — 110638-68-1.

Pharmacopoeias. In *US*.

USP 31 (Calcium Lactobionate). pH of a 5% solution in water is between 5.4 and 7.4.

Equivalence. Each g of calcium lactobionate (dihydrate) represents about 1.3 mmol of calcium. Calcium lactobionate (dihydrate) 19.7 g is equivalent to about 1 g of calcium.

Calcium Levulinate (BAN)

Calcii Laevulas; Calcii laevulinas; Calcii Laevulinas Dihydricus; Calcii Levulinas Dihydricum; Calcio, levulinato de; Calcium Laevulate; Calcium Levulinate; Calcium, lévulinat de; Calcio levulinatas; Kalciumlevulat; Kalcium-levulát dihydrát; Kalciumlevulinat; Kalciumlevulinát; Kalsiumlevulaatti; Kalsiumlevulinaatti; Lévlúinate Calcique. Calcium 4-oxovalerate dihydrate.

$C_{10}H_{14}CaO_6 \cdot 2H_2O = 306.3$.

CAS — 591-64-0 (anhydrous calcium levulinate); 5743-49-7 (calcium levulinate dihydrate).

ATC — A12AA30.

ATC Vet — QA12AA30.

Pharmacopoeias. In *Eur.* (see p.vii) and *US*.

Ph. Eur. 6.2 (Calcium Levulinate Dihydrate). A white or almost white, crystalline powder. Freely soluble in water; very slightly soluble in alcohol; practically insoluble in dichloromethane. A 10% solution in water has a pH of 6.8 to 7.8. Protect from light.

USP 31 (Calcium Levulinate). A white crystalline or amorphous powder, having a faint odour suggestive of burnt sugar. Freely soluble in water; slightly soluble in alcohol; insoluble in chloroform and in ether. pH of a 10% solution in water is between 7.0 and 8.5.

Equivalence. Each g of calcium levulinate (dihydrate) represents about 3.3 mmol of calcium. Calcium levulinate (dihydrate) 7.64 g is equivalent to about 1 g of calcium.

Calcium Phosphate

Calcii Phosphas; Calcio, fosfato de; Calcium Orthophosphate; E341; Fosfato Tricalcico; Fosforečnan vápenatý; Kalcio fosfatas; Kalcium-foszfát; Phosphate Tertiaire de Calcium; Phosphate tricalcique; Precipitated Calcium Phosphate; Tricalcii phosphas; Tricalcium Phosphate; Trikalciumfosfat; Trikalciumfosfaatti; Wapnia fosforan.

CAS — 7758-87-4 (tricalcium diorthophosphate); 12167-74-7 (calcium hydroxide phosphate).

ATC — A12AA01.

ATC Vet — QA12AA01.

Description. Calcium phosphate is not a clearly defined chemical entity but is a mixture of calcium phosphates that has been most frequently described as either tricalcium diorthophosphate, $Ca_3(PO_4)_2 = 310.2$, or calcium hydroxide phosphate, $Ca_5OH(PO_4)_3 = 502.3$.

Pharmacopoeias. In *Eur.* (see p.vii), *Int.*, and *Viet.* Also in *US-NF*.

Ph. Eur. 6.2 (Calcium Phosphate). It consists of a mixture of calcium phosphates and contains 35 to 40% of Ca. A white or almost white powder. Practically insoluble in water; dissolves in dilute hydrochloric acid and in dilute nitric acid.

The BP 2008 gives Tribasic Calcium Phosphate as an approved synonym.

USNF 26 (Tribasic Calcium Phosphate). It consists of a variable mixture of calcium phosphates having the approximate composition $10CaO \cdot 3P_2O_5 \cdot H_2O$. It contains not less than 34% and not more than 40% of calcium. A white, odourless, powder. Practically insoluble in water; insoluble in alcohol; readily soluble in 3N hydrochloric acid and in 2N nitric acid.

Calcium Pidolate (pINNM)

Calcii Pidolas; Calcium Pyroglutamate; Pidolate de Calcium; Pidolato de calcio. Calcium 5-oxopyrrolidine-2-carboxylate.

Кальций Пидолат

$Ca(C_5H_8NO_3)_2 = 296.3$.

CAS — 31377-05-6.

Equivalence. Each g of calcium pidolate (anhydrous) represents about 3.4 mmol of calcium. Calcium pidolate (anhydrous) 7.39 g is equivalent to about 1 g of calcium.

Calcium Silicate

Calcio, silicato de; E552.

CAS — 1344-95-2; 10101-39-0 (calcium metasilicate); 10034-77-2 (calcium diorthosilicate); 12168-85-3 (calcium trisilicate).

ATC — A02AC02.

ATC Vet — QA02AC02.

Description. A naturally occurring mineral, the most common forms being calcium metasilicate ($CaSiO_3 = 116.2$), calcium diorthosilicate ($Ca_2SiO_4 = 172.2$), and calcium trisilicate ($Ca_3SiO_5 = 228.3$). It is usually found in hydrated forms containing various amounts of water of crystallisation. Commercial calcium silicate is prepared synthetically.

Pharmacopoeias. In *USNF*.

USNF 26 (Calcium Silicate). Crystalline or amorphous calcium silicate is a compound of calcium oxide and silicon dioxide containing not less than 4% of CaO and not less than 35% of SiO_2 . A white to off-white free-flowing powder. Insoluble in water; with mineral acids it forms a gel. A 5% aqueous suspension has a pH of 8.4 to 11.2.

Calcium Sodium Lactate

Calcio, lactato sodico de.

$2C_3H_5NaO_3 \cdot (C_3H_5O_3)_2Ca \cdot 4H_2O = 514.4$.

Equivalence. Each g of calcium sodium lactate (tetrahydrate) represents about 1.9 mmol of calcium and 3.9 mmol of sodium and of lactate. Calcium sodium lactate (tetrahydrate) 12.8 g is equivalent to about 1 g of calcium.

Adverse Effects and Treatment

Oral calcium salts can cause gastrointestinal irritation; calcium chloride is generally considered to be the most irritant of the commonly used calcium salts.

Injection of calcium salts can also produce irritation, and intramuscular or subcutaneous injection in particular can cause local reactions including sloughing or necrosis of the skin; solutions of calcium chloride are extremely irritant and should not be injected intramuscularly or subcutaneously. Soft-tissue calcification has followed the use of calcium salts parenterally.

Excessive amounts of calcium salts may lead to hypercalcaemia. This complication is usually associated with parenteral use, but can occur after oral dosage, usually in patients with renal failure or who are also taking vitamin D. Symptoms of hypercalcaemia include anorexia, nausea, vomiting, constipation, abdominal pain, muscle weakness, mental disturbances, polydipsia, polyuria, nephrocalcinosis, renal calculi, and, in severe cases, cardiac arrhythmias and coma. Too rapid intravenous injection of calcium salts may also lead to symptoms of hypercalcaemia, as well as a chalky taste, hot flushes, and peripheral vasodilatation. Mild asymptomatic hypercalcaemia will usually resolve if calcium and other contributory drugs such as vitamin D are stopped (see also Vitamin D-mediated Hypercalcaemia, p.1668). If hypercalcaemia is severe, urgent treatment is required as outlined on p.1668.

Precautions

Solutions of calcium salts, particularly calcium chloride, are irritant, and care should be taken to prevent extravasation during intravenous injection. Calcium salts should be given cautiously to patients with renal impairment, or diseases associated with hypercalcaemia such as sarcoidosis and some malignancies. In