

SIDS INITIAL ASSESSMENT PROFILE

CAS No.	10043-52-4
Chemical Name	Calcium chloride
Structural Formula	CaCl ₂

SUMMARY CONCLUSIONS OF THE SIAR**Human Health**

Calcium chloride is easily dissociated into calcium and chloride ions in water. The absorption, the distribution and the excretion of the ions in animals are regulated separately. Both ions are essential constituents of the body of all animals. Calcium is essential for the formation of skeletons, neural transmission, muscle contraction, coagulation of the blood, and so on. Chloride is required for regulating intracellular osmotic pressure and buffering.

The acute oral toxicity is low: LD₅₀ in mice is 1940-2045 mg/kg bw, 3798-4179 mg/kg bw in rats, and 500-1000 mg/kg bw in rabbits. The acute oral toxicity is attributed to the severe irritating property of the original substance or its high-concentration solutions to the gastrointestinal tract. In humans, however, acute oral toxicity is rare because large single doses induce nausea and vomiting. The dermal acute toxicity is negligible: LD₅₀ in rabbits >5000 mg/kg bw. No significant change was found by gross necropsy examination except skin lesions at or near the site of administration. Hypercalcemia may occur only when there exists other factors that alter calcium homeostasis, such as renal inefficiency and primary hyperthyroidism.

Irritation/corrosiveness studies conducted under OECD test guidelines indicate that calcium chloride is not/slightly irritating to skin but severely irritating to eyes of rabbits. Prolonged exposure and application of moistened material or concentrated solutions resulted in considerable skin irritation, however. Irritating effect of the substance was observed in human skin injuries caused by incidental contact with the substance or its high-concentration solutions.

A limited oral repeated dose toxicity study shows no adverse effect of calcium chloride on rats fed on 1000-2000 mg/kg bw/day for 12 months. Calcium and chloride are both essential nutrients for humans and a daily intake of more than 1000 mg each of the ions is recommended. The establishment of the ADI for calcium chloride has not been deemed necessary by JECFA (Joint FAO/WHO Expert Committee on Food Additives). Considering further the well-established metabolism and mechanisms of action of calcium and chloride ions in the human body, no further study is considered necessary for this endpoint.

Genetic toxicity of calcium chloride was negative in the bacterial mutation tests and the mammalian chromosome aberration test.

No reproductive toxicity study has been reported. A developmental toxicity study equivalent to an OECD Guideline study, on the other hand, reveals no toxic effects on dams or fetuses at doses up to 189 mg/kg bw/day (mice), 176 mg/kg bw/day (rats) and 169 mg/kg bw/day (rabbits). In view of the nutritional aspects, the metabolism, and the mechanisms of action of calcium and chloride ions, no further study is considered necessary for these endpoints.

Environment

Calcium chloride's vapour pressure is negligible and its water solubility is 745 g/L at 20°C. Calcium chloride is readily dissociated into calcium and chloride ions in water. These physico-chemical properties indicate that calcium chloride released into the environment is distributed into the water compartment in the form of calcium and chloride ions.

Acute toxicity studies (lowest effect values) reveal a 72-hour EC₅₀ of 2900 mg/L for algae (*Selenastrum capricornutum*), a 48-hour EC₅₀ of 1062 mg/L for daphnids (*Daphnia magna*) and a 96-hour LC₅₀ of 4630 mg/L for fish (*Pimephales promelas*).

The chronic toxicity study with *Daphnia magna* shows that a 16% impairment of reproduction (EC₁₆) is caused at the concentration of 320 mg/L. The 72-hour EC₂₀ for *Selenastrum capricornutum* determined by the OECD TG 201 study is 1000 mg/L. All the data compiled on the acute and chronic toxicity are greater than 100 mg/L.

Calcium is known as an essential nutrient for higher plants and one of the basic inorganic elements of algae. Calcium plays crucial roles in strengthening cell walls and plant tissues, reducing the toxicity of soluble organic acids, elongating roots, and so on. Chloride is also an essential micronutrient for plants and has important roles in the photosynthesis and osmoregulation.

Deicing agents used as road salts are usually chloride salts, mainly sodium chloride or calcium chloride with minor amounts of magnesium chloride and potassium chloride. The primary cause of the damage to roadside plants is considered to be the accumulation of chloride in plant tissues to a toxic level by excess loading of inorganic chloride salts.

Calcium chloride constituted 2% of the total composition (approx. 5 million tonnes) of deicing agents used in Canada in the 1997-1998 winter season, while sodium chloride constituted 95% of the total. In addition, there is a report that shows the uptake of chloride by plants is considerably inhibited in the presence of calcium chloride. The impact of calcium chloride on plants is expected to be minimal compared to other chloride-containing agents, given the factors discussed above as well as the difference of usage of calcium chloride as compared to sodium chloride.

Exposure

The production capacity of calcium chloride in North America was reported in 2002 to be approximately 1,687,000 tonnes per year. The estimated production volume in Japan was approximately 245,000 tonnes in 2000. The total amount used in Western Europe including Scandinavia is around 300,000 tonnes per year.

Calcium chloride is produced in the closed system by refining of natural brine, by ammonia soda process as a by-product or by neutralization reaction of limestone with hydrochloric acid. Commercial products are supplied as flakes, pebbles, pellets, powders and solutions with varying concentrations. Calcium chloride is used for deicing, road stabilization, dust control, accelerator in concrete, industrial processing, oil and gas well fluids, and for others such as food additives and medication.

Almost half of the volume of calcium chloride is consumed as deicing agents and road stabilizers, and directly released into the environment, where the substance is dissociated into calcium and chloride ions. In the 1997-1998 winter season, 5 million tonnes of road salts including sodium chloride (95%), calcium chloride (2%), magnesium chloride, potassium chloride and ferrocyanide salts were used in Canada. Based on the global water quality monitoring conducted by UNEP, the mean, 10th-percentile and 90th-percentile of calcium concentrations in 76 rivers were 37.4, 5.1 and 86.5 mg/L, respectively. In addition, the mean, 10th-percentile and 90th-percentile of chloride concentrations in 77 rivers were 41.1, 1.1 and 64.8 mg/L, respectively. It should be noted that both the concentrations of calcium and chloride ions are tightly related to various factors, such as geological parameters, weathering and human activities.

As for human exposure, oral intake is expected via foods that contain calcium chloride in the dissociated form as food additives or as residues of food processing agents. There is potential for exposure to workers and consumers via skin contact and dust inhalation at working places or elsewhere by versatile uses such as road stabilizers.

RECOMMENDATION

The chemical is currently of low priority for further work.

RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

The chemical is currently of low priority for further work based on a low hazard potential.

Because of the effects of calcium chloride on soil dwelling organisms and plants and the exposure associated with the use of calcium chloride as a deicing agent in some countries, these countries may decide to assess the environmental risk related to this exposure scenario.