G E O®
SPECIALTY CHEMICALS

Calcium Formate
Product Data

Calcium Formate	TECHNICAL DATA SHEET

Calcium Formate, $(HCO_2)_2$ Ca

CAS Registry No.544-17-2

EINECS Registry No. 2088637

Calcium Formate is an odourless, free-flowing white crystalline solid. It is a convenient source of calcium and formate ions for aqueous solutions.

Specifications

Specifications	
Calcium Formate, wt %	98.0 min
Moisture, wt %	0.5 max
Water Insolubles, wt %	0.05 max

Typical Properties

Typical Properties	
Molecular Weight	130.12
Melting Point	decomposes
pH of 10% Water Solution	7.5
Bulk Density lbs / ft^3	72.6

Solubility

Solubility	
Grams / 100g Water	
@ 0°C	16.2
@ 100°C	18.4
Grams / 100g of Methanol	
@ 15°C	0.27
@ 66°C	0.23

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Uses

Leather Tanning

Calcium formate is used extensively in the leather industry as a masking agent in the chrome-tanning process. The addition of calcium formate to the tannage formulation promotes faster, more efficient penetration of the chrome in the leather. Calcium formate can also be used as a replacement for formic acid in the pickling operation.

Cement Additive

As an additive to grouts and cement, calcium formate imparts a number of properties desirable in the final product, e.g. increased hardness and decreased setting time in comparison to ordinary cements. The addition of calcium formate is desirable for work at low temperature and for inhibition of corrosion of metal substrates. It is also effective in the prevention of efflorescence. When used in gypsum board, calcium formate functions as a fire retardant.

Silage Treatment

Calcium formate is commonly used as a component of an ensiling agent for silage treatment. The use of calcium formate in the silage suppresses the formation of side reaction products such as propionic acid, while promoting the formation of desirable lactic acid in anaerobic fermentation.

Gas Generation

A mixture of calcium formate with ammonium nitrate or with chlorate, perchlorate, peroxide, superoxide or permanganate of an alkali metal will rapidly evolve large volumes of gas when ignited. Because the released gases are cool, non-poisonous and non-irritating, they could be used for the inflation of automobile passenger restraint bags or other similar applications.

Flue-gas Desulfurization

SO_x is abated in the flue-gases from the burning of high-sulfur fuel oil if the oil has been emulsified with a solution containing calcium formate before burning. As much as 95% of the SO_x is removed.

Safety Explosives

Calcium formate can be used as the fuel component in explosives designed to have improved deflagration behaviour. Such explosives are suitable for use in hazardous atmospheres often encountered in coalmines.

De- icing agent

Mixtures of calcium formate with urea are excellent agents for the melting of ice. Less corrosion of steel and cement surfaces is observed than with other de-icers.

Other uses

Calcium formate can be used as an additive to improve solution stability of various resins, as a corrosion inhibitor in moulding and wire-drawing operations, or as a catalyst in place of calcium acetate.

Buffered solutions

Buffered solutions exhibiting a range of pH values can be obtained by varying the ratio of formic acid to the salt as in table below:

Buffered Solutions									
Calcium Formate 0.1N, ml	10	20	30	40	50	60	70	80	90
Formic Acid 0.1N, ml	90	80	70	60	50	40	30	20	10
pH	2.81	3.10	3.32	3.50	3.67	3.80	4.0	4.23	4.58

Animal Feed Additive

Calcium formate is an organic salt suitable for use in pig and poultry diets. It acts as a feedstock preservative and has an acidifying effect on the gastro-intestinal tract, which promotes good gut-health. The efficiency of pig and poultry feedstock digestion is dependent on the indigenous micro-organism concentration in the gastro-intestinal tract. With the approaching ban on the use of prophylactic antibiotics in animal feed as a means to control disease and promote growth, alternatives are needed to limit the proliferation of pathogenic bacteria in the gut which can impair feedstock digestion as well as cause enteric diseases such as E. Coli and Salmonella. Acidifiers such as calcium formate preserve the feedstock before consumption and lower the pH in the gastro-intestinal tract, creating unfavourable conditions for these bacteria to grow.

Chemical Reactions

Calcium formate can be used to prepare solutions of other water-soluble formate salts. For example, the addition of nickel (II) sulfate to a solution of calcium formate results in the precipitation of insoluble calcium sulfate, leaving nickel (II) formate in solution:

$$Ca(OOCH)_2 + NiSO_1 \rightarrow CaSO_4 + Ni(OOCH)_2$$
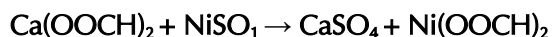
In a similar reaction, sulfuric acid reacts with calcium formate to provide low-cost solutions of formic acid:

$$Ca(OOCH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2HCOOH$$
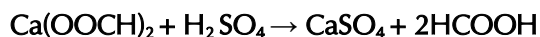
When heated, calcium formate decomposes to calcium carbonate and formaldehyde:

$$Ca(OOCH)_2 \rightarrow CaCO_3 + HCHO$$
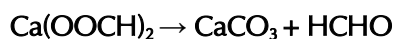
Continued heating at higher temperatures results in the breakdown of these decomposition products:

$$HCHO \rightarrow CO + H_2$$

$$CaCO_3 \rightarrow CaO + CO_2$$
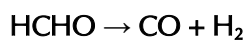
Calcium formate can be used as a low-cost reducing agent in the conversion of carboxylic acids to aldehydes*. This process is an effective substitute for the troublesome Rosenmund reduction.

$$(RCOO)_2Ca + (HCOO)_2CA \rightarrow 2RCH + 2CaCO_3$$
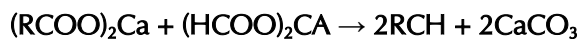
(* Eugen Muller, Methoden der organischen Chemie (Houben-Weyl), Vol. VII, Part 1, George Theime Verlag, Stuttgart, 1954, p.277.)

Toxicity

Calcium formate has a low order of toxicity. In rats, the acute oral LD_{50} is 2650mg / kg; by intravenous injection, the LD_{50} is 154mg / kg.

In a study with rats, calcium formate added to the drinking water at 0.2% for 3 years or 0.4% for 2 years didn't affect growth, fertility or function in up to 5 generations.

Calcium formate would be expected to be irritating to the eyes and skin. In case of eye contact, immediately flush the eyes with water for 15 minutes. Avoid prolonged or repeated exposure of the skin.

Refer to the product SDS for all safety and first aid information.

Shipping, Handling & Storage

Calcium formate is available in 50lb and 25kg multi-wall paper bags and 500lb mini sacks. Super sacks containing 1000kg (2205lb) are also available.

It is non-hygroscopic and if stored in a dry area no degradation should occur.

Shelf-life is minimum 3 years after production date if stored according to material safety data sheet handling instructions in the original unopened container.

The NPFA Hazardous Materials Identification System rating for calcium formate is: Health Hazard - 1; Flammability - 1; Reactivity - 0. This rating indicates that calcium formate is a minimal hazardous substance.

Calcium formate is classified as "DOT not regulated" by the US Department of Transportation. No special labelling is required for shipment. The Harmonized Tariff Code is 2915.12.0000.

Calcium formate is listed on the Chemical Substance Inventory under the US Toxic Substances Control Act, on the Canadian DSL and on the European Inventory of Existing Chemical Substances. The US and Canadian CAS Registry Number is 544-17-2 and the European EINECS Registry Number is 2088637.