



Tin (inorganic)

Updated: April 2016

Tin (Sn, CAS no. 7440-31-5) is a silver metal that occurs in the earth's crust mainly as cassiterite or tinstone (SnO_2) which is the main source of tin production [NTP]. Tin occurs in an inorganic form or in an organic form known as organotin.

Usage and Exposure

Tin has a relatively low melting point of 232°C and readily alloys with other metals. Liquid tin is used to make solders for joining other metals and tin-coated steel known as tinplate, which is used to make tin cans.

Copper/tin alloys are called “bronzes”. Approximately 90% of tin is used in high tin/antimony/copper alloys or Babbitt metal, die casting, and in pewter. Tin has a low melting point and a high boiling point of 2700°C . It is therefore ideal for producing “float glass” that consists of molted glass on molted tin to fabricate high-quality window glass [Zenz].

Inorganic tin compounds are produced by combining tin with chlorine, sulfur, or oxygen. Stannous sulfate, chloride, fluoride, and fluoroborate salts and potassium or sodium stannates are used for electroplating of tin and tin alloys [Zenz].

Occupational exposure to tin is significant in some industrial environments [ATSDR]. Workers in smelting operations may be exposed to tin oxide fumes. Plating operations and using molten tin drip tanks may expose workers to tin oxide dust and fumes. Workers engaged in the manufacturing of tin solder and other alloys are also exposed [LaDou].

Inorganic tin compounds are found in small amounts in the earth's crust. They are also present in perfumes, soaps, coloring agents, food additives, and dyes [ATSDR]. Stannous fluoride is well-known as a toothpaste additive.

Tin-lined cans used to package food are the most important contributor to dietary tin intake. Tin concentrations in foods depend on whether they are packaged in lacquered or unlacquered cans. Light colored fruit and fruit juices are packed in unlacquered cans, since tin helps maintain the color of the product [ATSDR].

Routes of Exposure

Exposure to inorganic tin may occur by inhalation or ingestion.

No data on the possibility of skin absorption is available [Westrum].

Target Organs

There are a limited number of studies on animals that have not clearly established potential target organs for inorganic tin toxicity [ATSDR].

Metabolism

Tin is a trace element that is required in bone formation [NTP].

Inhaled tin compounds remain in the lungs [LaDou]. Apart from the lungs, the organs with the highest tin concentrations in healthy adults are the kidneys, liver, bones and lymph nodes [MAK].

Inorganic tin is poorly absorbed from the gastrointestinal tract. Most of ingested tin is excreted with feces, while renal excretion is minor. [LaDou]. Absorbed tin is mostly excreted via urine [NTP].

Health Hazards

Acute Effects

No clinical or experimental reports on acute effects from inhalation of inorganic tin have been identified. Metal fume fever caused by inorganic tin has not been documented [Westrum].

No systemic toxic effects have been reported with inorganic tin compounds, but some inorganic compounds can cause skin or eye irritation. Stannous chloride and stannous sulfate are strongly acid, and potassium and sodium stannate are strongly alkaline [Zenz].

Generally, ingested inorganic tin compounds have relatively low toxicity. If high doses (more than 100 mg) are consumed, acute gastrointestinal effects similar to classical food poisoning such as nausea, vomiting, and diarrhea may occur [Zenz, ATSDR].

Chronic Effects

Prolonged inhalation of large amounts of fine tin oxide dust can lead to benign pneumoconiosis "stannosis" with radiological changes without impairment of pulmonary function [Zenz].

Uremic patients may be especially prone to accumulate trace elements from normal environmental sources. Elevated tin levels have been found in muscle, serum, liver and kidneys in uremic patients. Occupational exposure to tin has been found to induce an increased risk of chronic renal failure [Westrum].

There is no evidence that inorganic tin affects reproduction or development in humans, or that it is a neurotoxin or immunotoxin [ATSDR].

Carcinogenicity

There is no evidence that inorganic tin is a mutagenic or carcinogenic agent in humans. Animal studies for carcinogenicity of inorganic tin have been negative [ATSDR].

References:

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