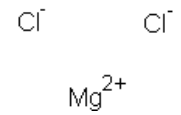
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	7786-30-3
Chemical Name	Magnesium chloride
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Physical and chemical properties

Magnesium chloride is a colourless crystalline powder with a melting point of 714 °C, a boiling point of 1412 °C. It has a density of 2.32 g/cm^3 and water solubility of 560 g/L at 25 °C. The vapour pressure, dissociation constants and partition coefficients are not applicable to inorganic salt.

Human Health

Magnesium is absorbed mainly in the small intestine after oral exposure; the colon also absorbs some. Magnesium absorption following oral ingestion is reported to range from 40 to 60%, with a lower percentage of absorption at higher daily intakes. Magnesium decreases the absorption of fluoride, and excess calcium may partially inhibit the absorption of magnesium. In the plasma, the level of magnesium is about 65% in ionic form, with the remainder bound to plasma proteins. Of the approximately 20 g body burden of magnesium, most is stored primarily in bone and muscle following absorption. Magnesium is excreted into the digestive tract by bile and pancreatic and intestinal juices. A small amount of radiomagnesium given intravenously appears in the gastrointestinal tract. The serum levels are remarkably constant. There is an apparent obligatory urinary loss of magnesium, which amounts to about 12 mg/day and the urine is the major route of excretion under normal conditions. Unabsorbed magnesium is excreted in the feces. Magnesium excretion can also occur via the sweat and breast milk.

The acute oral LD_{50} value for female rats lay between 300 and 2,000 mg/kg bw/day and was estimated to be 1,085 mg/kg bw/day. Dead animals had gastric filling with the test substance. At 300 mg/kg bw/day no treatment related clinical signs and no mortality were observed. There were normal body weight gains in all animals. At the end of the study, necropsy was conducted on all animals and no abnormal gross findings were observed. The 24-hour dermal LD_{50} value was in excess of 2,000 mg/kg bw/day in male and female rats. Signs of toxicity such as diarrhea and watery diarrhea were observed at 2,000 mg/kg bw/day.

The skin sensitization of magnesium chloride has been investigated in female of guinea pig (5weeks) following the study [OECD TG 406] and there was no evidence of skin sensitization.

The repeated dose toxicity of magnesium chloride has been investigated in two studies. In a repeated dose oral toxicity study [OECD TG 407], the substance was administered via gavage to rats(5/sex/dose) at 0, 250, 500 and 1,000 mg/kg bw/day for 28 days. No death were observed in either sex. The sporadically increased respiration was observed from day 7 in three females at 1,000 mg/kg bw/day. However, treatment related effects on body weight gain, food consumption, haematology, clinical biochemistry, organ weight changes, macroscopical/histopathological findings) were not observed at any dose. Based on these results, the NOAEL for repeated dose oral toxicity was considered to be 1,000 (males) and 500 (females) mg/kg bw/day.

Sprague-Dawley Rats were treated by gavage at doses of 0, 250, 500, or 1,000 mg/kg bw/day [OECD TG 421].

Males in the main group were administered for a total of 42 days, and females in the main group were administered for two weeks. In males and females dosed with 500 and 1,000 mg/kg bw/day, soft stool, diarrhea and salivation were observed and shown to be dose-dependent during the dosing period. These were considered to be overdoses of the test substance since diarrhea and digestive disorders can be caused by overdoses of mineral such as magnesium. There were no differences on food consumption in all the dosed groups compared to the control. In males dosed with 500 and 1,000 mg/kg bw/day and in females dosed with 1,000 mg/kg bw/day, body weights showed a decreasing tendency compared to the control group. These were considered to be indirect effects by soft stool and diarrhea with overdoses of the test substance. In the 250 mg/kg bw/day dosed group, soft stool was observed occasionally, but body weights were not changed. The LOAEL was 500 mg/kg bw/day, based on a dose-dependent decrease in male bodyweight and a dose-dependent increase in salivation in both males and females. The NOAEL was 250 mg/kg bw/day.

In a bacterial reverse mutation assay [OECD TG 471] with multiple strains of *Salmonella typhimurium* and *Escherichia coli* WP2*uvr*A, magnesium chloride was negative with and without metabolic activation. An *in vitro* chromosomal aberration test [OECD TG 473] was negative with and without metabolic activation. An *in vivo* micronucleus test [OECD TG 474] was performed with mice. The incidence of micronuclei was evaluated in polychromic erythrocytes of bone marrow. In the main test, mice were administered by intraperitoneally (i.p) two times with the test substance at dose levels of 30, 60 or 120 mg/kg bw/day and negative and positive control groups were treated with distilled water and mitomycin C, respectively. According to the results, magnesium chloride did not form micronucleus in bone marrow cells. Based on these results, magnesium chloride is considered to be non genotoxic *in vitro* and *in vivo*.

The carcinogenic potential of magnesium chloride has been investigated in one study. In an oral carcinogenicity study [no guideline followed], the substance was administered via the diet to mice (50/sex/dose) at 0, 570 or 2,810 mg/kg bw/day for males and 0, 730 or 3,930 mg/kg bw/day for females, for 104 weeks. Survival rates did not differ between the treatment and control groups for males or females. In females of the high-dose group a decrease in body weight was observed. Clinical signs and urinary, haematological or serum clinical chemistry parameters showed no treatment related toxic effects. On histological examination, tumours were mainly found in the skin and subcutis, liver and lymphatic system. With the exception of a significant decrease in the incidence of liver tumours among males of the high dose group, no differences were noted in the tumour incidence between the treated and control animals. Based on these results, magnesium chloride is considered to have no carcinogenic-potential.

Magnesium chloride has been investigated in a reproductive and developmental toxicity screening test in rats [OECD TG 421]. Rats were treated by gavage at doses of 0, 250, 500 or 1,000 mg/kg bw/day. Males were dosed once daily for a total of 42 days (two weeks each prior to, during and post mating), and females once daily for two weeks prior to mating, throughout gestation and four days after delivery. During the study, no necropsy findings and histopathological changes in lungs were found in one dead male and three dead females dosed with 1,000 mg/kg bw/day. The mating and gestation periods, mating index, fertility index and gestation index did not show statistically significant differences between the dosed groups and the control group. Normal parturition, mean litter size, pre- and post-implantation loss rate, live birth index and viability index on postnatal Days 0 and 4 were observed in all the dosed groups compared to the control group. There were no effects on the sex ratio, external findings, body weights and clinical signs of pups. Moreover, no differences were noted in absolute and relative organ weights of testes, epididymis, uterus, and ovaries, and no histopathological changes were observed. No adverse effects were noted in reproduction parameters of parents or the development of the pups in any of the dosed groups. In conclusion, the NOAEL for reproductive and developmental toxicity was 1000 mg/kg bw/day.

Magnesium chloride does not present a hazard to human health due to its low hazard profile. Adequate screening-level data are available to characterize a human health hazard for the purposes of the OECD HPV Programme.

Environment

Given its high solubility in water, magnesium chloride will dissociate and release Mg^{2+} and Cl^- ions. The dissociated Mg^{2+} cation can then transform and form complexes with dissolved ligands present in natural

waters. Magnesium is widespread in living cells and does not bioconcentrate in aquatic organisms. Environmental fate analysis based on log Kow and log Koc and typical fugacity modelling is not applicable to magnesium chloride as it is an inorganic compound. Photodegradation and biodegradation are also not applicable to inorganic metal salts such as magnesium chloride.

The following acute toxicity test results have been determined for aquatic species:

Fish	[*Oryzias latipes*]	96 h-LC_{50} > 95.2 mg/L (OECD TG 203, measured)
	[*Pimephales promelas*]	96 h-LC_{50} = 2,120 mg/L (EPA guidance, nominal)
Invertebrate	[*Daphnia magna*]	48 h-EC_{50} > 88.7 mg/L (OECD TG 202, measured)
	[*Daphnia magna*]	48 h-LC_{50} = 1,330 mg/L (EPA guidance, nominal)
	[*Ceriodaphnia dubia*]	48 h-LC_{50} = 880 mg/L (EPA guidance, nominal)
Algae	[*Pseudokirchneriella subcapitata*]	72 h-E_rC_{50} > 82.7 mg/L (OECD TG 201, growth rate) (measured)
		72 h-E_yC_{50} > 82.7 mg/L (OECD TG 201, yield) (measured)

Chloride (Cl^-) and magnesium (Mg^{+2}) are both essential nutrients important for normal plant growth. High concentrations of $MgCl_2$ ions in the soil may be toxic or change water relationship in the plant resulting in diminished accumulation of water and nutrients. Once inside the plant, chloride moves through the water-conducting system and accumulates at the margins of leaves or needles, where dieback occurs first. Leaves are weakened or killed, which can lead to the death of the tree.

Magnesium chloride does not present a hazard to the environment due to its low hazard profile. Adequate screening-level data are available to characterize the environmental hazard for the purposes of the OECD HPV Programme.

Exposure

In the Republic of Korea, [sponsor country], the import and export volumes of magnesium chloride were 463 and 19 tonnes in 2006, respectively. At present, magnesium chloride is not produced in the sponsor country and the volume of use was 38,100 tonnes. The volumes of the import and export in the US were 6,914 and 4,763 tonnes in 1990, respectively. In European Nordic countries estimated use amounts of magnesium chloride were approx. 3,100, 3,080 and 3,390 tonnes in 2006, 2007 and 2008, respectively. The annual demand for magnesium chloride in Canada was 9 kilotonnes in 2005 and projected to be 10 kilotonnes in 2010.

Magnesium chloride is used as thickening agent in the production of synthetic detergents, intermediates, surface-active agents, anti-condensation agents, flame retardants and fire preventing agents, catalyser and flux agents for casting in the sponsor country. It is also used for a source of magnesium metal, magnesium oxychloride cement, refrigerating brines, ceramics, cooling drill tools, textiles, paper manufacture, road dust-laying compounds, road anti-icer and de-icing additive. It is estimated that 90% of Canadian consumption of magnesium chloride is for use as a dust suppressant and the remainder is for ice control. Magnesium chloride is used in pills as supplemental sources of magnesium, an important coagulant used in the preparation of tofu from soy milk and an ingredient in baby formula milk. Magnesiun chloride is the main component of seawater bittern and used as firming agent, colour fixing agent and fortifying nutrient(food additive). The consumer may be exposed to small quantities of magnesium chloride by the consumption of food and drink.

In the manufacturing facilities of synthetic detergents, magnesium chloride is handled in a continuous closed system in the sponsor country. Occupational exposure is managed with local ventilation systems and personal protective equipments such as dust masks, gloves and goggles. According to the monitoring data, the 8hr-TWA (Time Weighted Average) concentrations of hazard materials for workplaces were not detected. Wastewater of each process is well controlled by physical and chemical treatment (e.g., floatation, sedimentation, sand filtration), consequently producing lower values than control standards. Occupational exposure is considered to be negligible in the sponsor country.