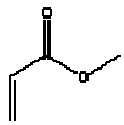
SIDS INITIAL ASSESSMENT PROFILE

CAS No.	96-33-3
Chemical Name	Methyl Acrylate
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

Methyl acrylate is readily absorbed by all exposure routes and rapidly hydrolyzed by carboxyesterases to acrylic acid and methanol. Greater than 90% is excreted within 72 hours, primarily via the lungs (> 50%) as CO_2, and kidneys (40-50%) as products of glutathione conjugation.

The acute toxicity of methyl acrylate is moderate by the oral, dermal and inhalation routes: LD_{50} rat (oral): 765 mg/kg bw; symptoms: staggering, apathy, labored breathing; LC_{50} rat (inhalation, vapor): 5.7 mg/L/4h; symptoms: respiratory tract and eye irritation; LD_{50} rabbit (dermal): 1250 mg/kg bw; symptoms: not reported. Methyl acrylate is highly irritating to the skin, eyes, and mucous membranes of animals and humans. It may cause serious damage to eyes. Methyl acrylate was shown to induce contact sensitivity in animals and humans. Cross-reactivity to other acrylates and methacrylates is known to occur.

In repeated-dose studies, the main effects observed following inhalation exposure were irritation of the respiratory tract and mucous membranes. Systemic effects were mainly associated with changes in body weights and organ weights. In a two-year bioassay, rats were exposed via inhalation to methyl acrylate at 15, 45, 135 ppm (0.058, 0.173, 0.519 mg/L) in which a concentration-dependent opacity and neovascularization in the rat cornea, and degeneration of the olfactory epithelium were observed. The only systemic effects observed were a slight and reversible delay in body weight gains along with changes in organ weights without histological correlation (mainly in the highest dose group.) The LOAEC for nasal (slight degeneration of the olfactory epithelium) and ocular effects was 15 ppm (0.058 mg/L).

In a sub-chronic inhalation study (12 weeks) with rats exposed to 23, 124, 242, 626 ppm (0.082, 0.44, 0.86 2.23 mg/L), reduced body weight gain was seen to be treatment related in the 124-626 ppm groups (0.440 –2.23 mg/L). Increased relative lung and relative liver weights were observed in the 242 ppm group, and in the females of the 124 ppm group without detectable microsopic changes in these organs. Absolute organ weights of heart, liver, kidney and spleen were decreased in males of the 242 ppm dose group; absolute spleen weight of males was also reduced in the 124 ppm group. The NOEC was 23 ppm (0.082 mg/L). The LOEC was 124 ppm (0.44 mg/L) (reduced body weight, reduced organ weights.) The NOEL following a 3-month oral administration to rats in drinking water was 5 mg/kg bw. At 20 mg/kg bw/d an increased incidence of a renal disease was observed together with an increase in the mean relative kidney weights.

In vitro, methyl acrylate was negative in a variety of studies for point mutation both in the presence (Ames test only) and in the absence of metabolic activation, but induced chromosome aberrations in Chinese hamster cells in the absence of metabolic activation. Reliable animal mutagenicity studies do not suggest a clastogenic potential under *in vivo* conditions.

Methyl acrylate was not carcinogenic in a 2-year inhalation study in Sprague-Dawley rats up to the highest tested dose of 135 ppm (0.519 mg/L).

Although no reproductive toxicity studies were available, methyl acrylate showed no adverse effects on reproductive organs in well-performed repeated-dose inhalation and oral studies. Inhaled methyl acrylate was not toxic to the embryo or fetus, except at concentrations that produced overt maternal toxicity in a developmental toxicity study in rats. The NOEL for maternal toxicity was 25 ppm (0.089 mg/L), the NOEL for developmental effects (fetotoxicity) was 50 ppm (0.179 mg/L), and the NOEL for developmental effects (teratogenicity) was 100 ppm (0.358 mg/L) (highest dose tested).

Environment

The water solubility of methyl acrylate is 52 g/L (25 °C) and specific gravity is 0.956 g/cm^3 at 20 °C. The measured log Kow is 0.74. The vapor pressure is 89.2 hPa at 20 °C. The melting point is - 75°C and the boiling point is 80 °C. Methyl acrylate is highly flammable and has explosive properties. Methyl acrylate is photodegraded by reaction with hydroxyl radicals in the atmosphere with a half-life of 13.6 hours (calculated). The hydrolysis rate of methyl acrylate is low. At pH 7, the half-life is > 28 days. Distribution modeling using Mackay Level I indicates that the main target compartment will be air (83.58 %) with smaller amounts partitioning into water (16.4 %) soil (0.1 %) and sediment (0.1 %). Fugacity model Level III, using US EPA TRI data for realistic release percentages, shows similar results: 92.2 % (air), 7.25 % (water), 0.56 % (soil) and 0.0127 % (sediment). A BCF of 3.162 was determined, based on a log K_{ow} of 0.74, indicating a low bioaccumulation potential. Methyl acrylate attained 59.8% biodegradation within 28 days in a closed bottle test according to OECD 301 D. In a CO_2-Headspace test according to ISO 14593 (identical to OECD Test Guideline 310), methyl acrylate was readily biodegradable (99. % TIC of ThIC after 28 days).

Methyl acrylate is reported to have acute toxicity to aquatic organisms based on measured concentrations. The most sensitive fish species reported was sheepshead minnow (*Cyprinodon variegatus*) with a 96-h LC_{50} value of 1.1 mg/L. In aquatic invertebrates, the 48-h EC_{50} for *Daphnia magna* was 2.6 mg/L. In algae, (*Selenastrum capricornutum*) the 72-hr EC_{50} for growth rate and biomass were 3.55 and 2.02 mg/L, respectively. The 96-hr EC_{50} for growth rate and biomass were 4.75 mg/L and 1.99 mg/L, respectively. In activated sludge, the inhibition of respiration for microorganisms was reported as a 5-d EC_{50} value >100 mg/L.

Exposure

Methyl acrylate is manufactured as a chemical intermediate in a closed system. Its primary use is as a co-monomer in the preparation of polyacrylic fibers, in the manufacture of plastics, coatings, dispersions, flocculants and varnishes and in organic synthesis.

The worldwide annual production volume of methyl acrylate is between 100,000 and 200,000 tonnes. In 2000, three sites in Europe were reported to have produced a total of 50,000 to 100,000 tonnes and two sites in the NAFTA region were reported to have produced a total of 50,000 to 100,000 tonnes. In the US, six companies were reported to have produced a total of 45,000 to 127,000 tonnes in 1998. In 2000, US TRI reporting indicates that the majority of methyl acrylate was released to the air compartment (95%, 320,278 pounds). However, a small percentage was released to the water compartment (0.09%, 294 pounds).

In Western Europe, emissions from the production of methyl acrylate averaged 70 g/tonne (to water) and 30g/tonne (to air) produced. From polymer production plants using methyl acrylate, emissions were up to 1 g/tonne (to water) and around 5 g/tonne (to air). Negligible releases to the water compartment from residues in polymers are expected. Impact on the environment is expected to be low due to photolysis and biodegraditive properties of methyl acrylate. Extensive occupational exposure monitoring records are available which indicate that 8 hr TWAs for a variety of operations were generally below the regulatory/guideline values. However, peak exposures were reported that in some circumstances exceeded the NIOSH REL of 10 ppm (TWA) during sampling, cleaning, filter cleaning and inhibitor preparation. Records indicate that personnel performing these tasks wear the appropriate personal protective equipment and therefore, exposures to personnel are estimated to be lower depending upon protection factors of the personal protective equipment. End use consumer products contain only trace levels of acrylic acid and esters (as a result of polymerization). Residual monomer concentrations in consumer polymer products are very low and releases are negligible. Therefore, consumer exposure to acrylate monomers is likely to be low.

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

The chemical possesses properties indicating a hazard for human health (skin sensitization, skin, and eye irritation) and the environment. Based on data presented by the Sponsor country, exposure to humans and the environment is anticipated to be low, and therefore this chemical is currently a low priority for further work. Countries may desire to investigate any exposure scenarios that were not presented by the Sponsor country.