BASIC ACRYLIC MONOMER MANUFACTURERS, INC.

SUBSTANCE REVIEW: METHYL ACRYLATE

(Last Updated: 5/7/12)

Disclaimer

Substance	Acronym	CAS Number
Methyl acrylate	MA	96-33-3

Physicochemical Properties

Property	Results
Physical state at 20°C and 1013 hPa	liquid Form: volatile Color: colorless Odor: acrid odor
Melting / freezing point	-76.5 °C
Boiling point	80.1°C at 1013hPa
Relative density	0.95 g/cm^3 at 20°C
Vapor pressure	90 hPa at 20°C
Surface tension	not surface active
Water solubility	60 g/l at 20°C
Partition coefficient n-octanol/water (log value)	0.739 at 25°C
Flash point	-2.8°C
Flammability	Highly flammable. The substance has no pyrophoric properties and does not liberate flammable gases on contact with water.
Explosive properties	non explosive
Self-ignition temperature	468°C at 1013hPa
Oxidizing properties	no oxidizing properties
Granulometry	not applicable
Stability in organic solvents and identity of relevant degradation products	not applicable
Dissociation constant	not applicable
Viscosity	0.472 mPa.s at 25°C

Environmental Fate

In contact with water, MA will hydrolyze slowly. Photodegradation in air will proceed slowly, too. In water, sewage treatment plants and soil rapid degradation is expected, since MA was readily biodegradable in an OECD 310-Screening test. Based on an experimental log Pow and subsequently calculated BCF, a potential for bioaccumulation is no expected. Adsorption of MA to the solid soil phase is not expected. The estimated Koc indicates that MA will exhibit a very high mobility in soil.

Fugacity model calculation (Mackay Level I) revealed the atmosphere as the main target compartment for distribution which is also indicated by the substance's physicochemical properties.

Ecotoxicity

When evaluated as a group, the acrylate esters have similar ecotoxicity data. LC50 values in freshwater fish ranged from 1.81 and 5.2 mg/L, EC50 values in freshwater invertebrates (Daphnia magna) were between 1.3 and 8.74 mg/L, and EC50 values in freshwater algae were between 1.71 and 14.6 mg/L, respectively. Thus, effect values were all in the same range of concentrations with Daphnia magna as the most sensitive freshwater species by a narrow margin. A 21-day chronic life-cycle study with Daphnia magna is available with ethyl acrylate with a respective NOEC of 0.19 mg/L, and another with n-butyl acrylate with a NOEC of 0.136 mg/L. In addition, several NOEC values from studies in algal species are available ranging from 0.45 to 3.85 mg/L.

HUMAN HEALTH EFFECTS

Acute Toxicity

Methyl acrylate is of moderate toxicity after single ingestion and after short-term skin contact. MA is of moderate toxicity after short-term inhalation.

- Oral: LD50 ca. 768 mg/kg bw (rat)
- Dermal: LD50 ca. 1250 mg/kg bw (rabbit)
- Inhalation: LC50 = 6.5 mg/L (rat)

Irritation/Sensitization

Skin contact with MA causes irritation. MA may be irritating to the respiratory system, and may cause severe damage to the eyes. After repeated skin contact with MA sensitization is possible.

Repeated Dose Toxicity

In a subchronic study in Sprague-Dawley rats following vapor inhalation for 12-weeks, the NOAEC was 82 mg/m^3. The LOAEC based on reduced body weight and reduced organ weights was 440 mg/m^3. Following chronic exposure by the inhalation route (5 d/w, 6 h/d), the LOAEC for local effects (nasal and ocular) in rats was 58 mg/ m^3. The systemic NOAEC was >= 519 mg/ m^3. Following a 90-day oral administration of MA in the drinking water, the NOAEL was 5 mg/kg bw/d for CDF Fischer 344 rats. The LOAEL was 20 mg/kg bw/day based on changes in kidney weights.

Genetic Toxicity

Methyl acrylate was negative in bacterial mutation tests. In gene mutation assays in mammalian cells, i.e. HGPRT and XPRT assays, MA was clearly negative. MA seems to have some potential for genotoxicity in mammalian cells, presumably by a clastogenic mechanism. Since this effect is limited to doses with moderate to strong cytotoxicity, it is highly unlikely that this potential will be expressed in vivo. MA was negative in several in vivo mouse micronucleus assays. Thus, taking the negative test results in vivo for MA into consideration, it can be assumed that MA will not cause any DNA damage, i.e. genotoxicity in vivo.

Developmental/Reproductive Toxicity

In a two-generation study in which groups of rats were whole-body exposed to methyl acrylate vapors, no effects on reproductive function (i.e. fertility) were observed. The NOAEC for reproductive function was 75 ppm (= ca. 0.268 mg/L). In this study, the no-observed-effect concentration (NOEC) for parental systemic toxicity was based on microscopic changes in the nasal tissues seen at higher concentrations. Secondary to this parental toxicity pup body weights were decreased, but no further developmental effects were observed.

Carcinogenicity

Methyl acrylate showed no evidence of carcinogenicity in a 2-year vapor inhalation study in Sprague-Dawley rats up to the highest tested dose (135 ppm = 0.519 mg/L).

Toxicokinetics

Methyl acrylate is readily absorbed by the oral, dermal and inhalation routes and the major portion is 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 MA-glutathione conjugation.

Dermal absorption is somewhat slower and appears to follow irritation of the skin, possibly reflecting an initial de-esterification, with subsequent absorption of the acrylic acid formed.

Disclaimer