3	CAS No.: 96-33-3	Substance: Methyl acrylate

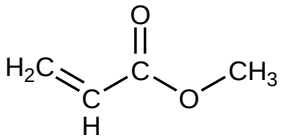
Chemical Substances Control Law Reference No.: 2-987

PRTR Law Cabinet Order No.: 1-6 (Cabinet Order No. after revision*: 1-8)

Structural Formula:

Molecular Formula: $C_4H_6O_2$

Molecular Weight: 86.09



*Note: No. according to revised order enacted on October 1, 2009.

1. General information

The aqueous solubility of this substance is 4.94×10^4 mg/1000 g (25°C), the partition coefficient (1-octanol/water) (log Kow) is 0.8, and the vapor pressure is 82.5 mmHg (=1.1×10^4 Pa) (25°C). Biodegradability (aerobic degradation) is considered to be good. Its half-life for hydrolysis is 2.8 years (25°C, pH =7) .

This substance was designated as a Class 1 Designated Chemical Substance under the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (PRTR Law), and this continues to be the case after the revision of substances regulated by the PRTR Law (enacted on October 1, 2009). It is primarily used in large volumes as a raw material for acrylic fiber. It is also used as a synthetic resin, as a raw material for synthetic resins such as methyl methacrylate resin, and as a raw material for acrylic resins used in coatings and adhesives. The production (shipments) and import quantity in fiscal 2004 was 10,000 to <100,000 t and the export quantity in fiscal 2004 was 5,868 t. The production and import category under the PRTR Law is 10,000 t.

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2. Exposure assessment

Total release to the environment in fiscal 2006 under the PRTR Law was 52 t, of which 29 t, or 56% of overall releases, was reported releases. The major destination of reported releases was the atmosphere. Besides this, approximately 19 t was transfer to waste. Industry types that reported large releases to the atmosphere were the chemical industry and the plastic product manufacturing industry. Those that reported releases to water for public use were the plastic product manufacturing industry and the chemical industry. Of the non-reported releases to the environment, most is estimated to have been released to the atmosphere. A multi-media model to predict the distribution into each environmental medium indicated that in regions where the largest quantities were estimated to have been released to public water bodies and the atmosphere, the proportion distributed to water bodies would be 95.2%.

The predicted maximum exposure to humans via inhalation, based on general environmental atmospheric data, was less than around 0.0006 μg/m^3, but there is a report of 0.053 μg/m^3 for a limited area (Tokyo Metropolis). On the other hand, the mean annual value for atmospheric concentration in fiscal 2006 calculated using a plume-puff model based on reported releases to the atmosphere according to the PRTR Law was a maximum of 0.52 μg/m^3.

The predicted maximum oral exposure was estimated to be less than around 0.0004 μg/kg/day based on calculations from data for groundwater and around 0.0004 μg/kg/day based on data from public freshwater bodies. A predicted maximum oral exposure of around 0.0004 μg/kg/day is adopted for this substance. On the other hand, when reported releases to public freshwater bodies in fiscal 2006 according to the PRTR Law are divided by the ordinary water discharge of the national river structure database, estimating the concentration in rivers solely taking dilution into consideration gives a maximum value of 0.06 μg/L. Using this estimated concentration for rivers to calculate oral exposure gives 0.0024 μg/kg/day. The risk of exposure to this substance by intake from an environmental medium via

food is considered slight.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was around 0.01 μg/L for public freshwater bodies and less than around 0.01 μg/L for seawater. The river concentration estimated using reported releases based on the PRTR Law was a maximum of 0.06 μg/L.

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3. Initial assessment of health risk

This substance is irritating to skin and respiratory tracts, and it is severely irritating to eyes. When inhaled, it will cause coughing, short breaths or sore throat. When taken orally, it will cause abdominal pain, diarrhea, nausea and vomiting. When it contacts with eyes or skin, there will occur rubefaction or pain.

Sufficient information could not be obtained on its carcinogenicity, and its initial assessment was conducted on the basis of data on its non-carcinogenic effects.

As for its oral exposure, its no-observed-adverse-effect-level (NOAEL) of 5 mg/kg/day (for suppressed increase of body weight, relative increase of kidney weight to body weight) obtained from its mid-term and long-term toxicity tests for rats was divided by 10, due to their short test periods, to produce 0.5 mg/kg/day as its reliable minimal dose to be regarded as its 'non-toxic level*'. As for its inhalation exposure, its LOAEL of 14 ppm (for atrophy/hyperplasia of olfactory epithelia) obtained from mid-term and long-term toxicity tests for rats was adjusted against exposure conditions to produce 2.5 ppm (8.8 mg/m^3). Since this was LOAEL, it was then divided by 10 to provide 0.88 mg/m^3 as its 'non-toxic level*'.

As for its oral exposure, its maximum exposure was estimated to be around 0.0004 μg/kg/day, when intakes of freshwater in public water bodies were assumed. Its margin of exposure (MOE) would be 130,000, when calculated from its 'non-toxic level*' of 0.5 mg/kg/day and its estimated maximum exposure, and then divided by 10 due to the fact that the 'non-toxic level*' was obtained from animal experiments. Since risk associated with exposure to this substance through food intakes from the environment is presumed to be minimal, this exposure will not increase MOE significantly. Oral exposure of 0.0024 μg/kg/day would be obtained when its concentrations in river water were estimated on the basis of its discharges reported under the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management. No further action, therefore, will be required at the moment to assess health risk from oral exposure to this substance.

As for its inhalation exposure, its maximum exposure was estimated to be less than 0.0006 μg/m^3, when its concentrations in the ambient air were considered. Its margin of exposure (MOE) would be more than 150,000, when calculated from its 'non-toxic level*' of 0.88 mg/m^3 and its estimated maximum exposure, and then divided by 10 due to the fact that 'non-toxic level*' was obtained from animal experiments. Reports of its concentrations in the ambient air for some locations suggest that its maximum concentration at national level would be 0.053μg/m^3. When combined with its 'non-toxic level*', MOE of 1,700 would be obtained. If MOE were calculated from its concentration of 0.52 μg/m^3 in the ambient air estimated from reports of its discharges under the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management, it would be 170. No further action, therefore, will be required at the moment to assess health risk from inhalation exposure to this substance in the ambient air.

Information of toxicity				Exposure assessment		Result of risk assessment			Judgment
Exposure Path	Criteria for risk assessment	Animal	Criteria for diagnoses (endpoint)	Exposure medium	Predicted maximum exposure quantity and concentration				
Oral	'Non-toxic level*' 0.5 mg/kg/day	Rats	Inhibited weight increase, increase in relative kidney weight	Drinking water	– μg/kg/day	MOE	–	×	○
				Freshwater	<0.0004 μg/kg/day	MOE	> 130,000	○	
Inhalation	'Non-toxic level*' 0.88 mg/m^3	Rats	Atrophy of the olfactory epithelium, corneal degeneration, etc.	Ambient air	<0.0006 μg/m^3	MOE	>150,000	○	○
				Indoor air	– μg/m^3	MOE	–	×	×

Non-toxic level *

・When a LOAEL is available, it is divided by 10 to obtain a level equivalent to NOAEL.

・When an adverse effect level is available for the short-term exposure, it is divided by 10 to obtain a level equivalent to an adverse effect level for the long-term exposure.

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4. Initial assessment of ecological risk

With regard to acute toxicity, the following reliable data were obtained: a 72-h median effective concentration (EC_{50}) of 3,130 μg/L for growth inhibition in the green algae *Pseudokirchneriella subcapitata;* a 48-h EC_{50} of 2,640 μg/L for swimming inhibition in the crustacean *Daphnia magna*, and a 96-h median lethal concentration (LC_{50}) of 1,360 μg/L was obtained for the fish species *Oryzias latipes* (medaka). Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 14 μg/L was obtained. With regard to chronic toxicity, the following reliable data were obtained: a 72-h no observed effect concentration (NOEC) of 1,140 μg/L for growth inhibition in the green algae *P. subcapitata*, and a 21-d NOEC of 360 μg/L was obtained for reproductive inhibition in the crustacean *D. magna*. Accordingly, based on these chronic toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 3.6 μg/L was obtained. The value of 3.6 μg/L obtained from the chronic toxicity to the crustacean was used as the PNEC for this substance.

The PEC/PNEC ratio was 0.003 for freshwater bodies and less than 0.003 for seawater. The ratio of the river concentration estimated using reported releases based on the PRTR Law of 0.06 μg/L to PNEC is 0.02. Accordingly, further work is thought to be unnecessary at this time.

Hazard assessment (basis for PNEC)			Assessment factor	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Result of assessment
Species	Acute/ chronic	Endpoint			Water body	Predicted environmental concentration PEC (μg/L)		
Crustacean (water flea)	Chronic	NOEC Reproductive inhibition	100	3.6	Freshwater	0.01	0.003	○
					Seawater	<0.01	<0.003	

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work.	○
	Inhalation exposure	No need for further work.	○
Ecological risk	No need for further work.		○

［Risk judgments］ ○: No need for further work ▲: Requiring information collection

■: Candidates for further work ×: Impossibility of risk characterization

（○）: Though a risk characterization cannot be determined, there would be little necessity of collecting information.

（▲）: Further information collection would be required for risk characterization.