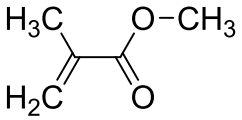
18	CAS No.: 80-62-6	Substance: Methyl methacrylate

Chemical Substances Control Law Reference No.: 2-1036

PRTR Law Cabinet Order No.: 1-420

Molecular Formula: $C_5H_8O_2$ Structural Formula:

Molecular Weight: 100.12



1. General information

The aqueous solubility of this substance is 1.50×10^4 mg/L (25°C), the partition coefficient (1-octanol/water) (log K_{ow}) is 1.38, and the vapor pressure is 38.3 mmHg (=5.10×10^3 Pa) (25°C). Biodegradability (aerobic degradation) is judged to be good. Its half-life for hydrolysis is 4 years (pH=7, 25°C).

This substance is 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). The main use of this substance is as a raw material for synthetic resins, including coating resins such as methacrylic resin as well as transparent ABS resin. The production and import quantity in fiscal 2010 was 300,000 t. The production and import category under the PRTR Law is more than 100 t.

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2. Exposure assessment

Total release to the environment in fiscal 2010 under the PRTR Law was approximately 470 t, of which approximately 440 t or 92% of overall releases were reported. The major destination of reported releases was the atmosphere. In addition, approximately 600 t was transferred to waste materials, and approximately 0.17 t was transferred to sewage. Industry types with large reported releases were the chemical industry and the plastic products manufacturing industry for the atmosphere, and the chemical industry alone for public water bodies. The largest release among releases to the environment including those unreported was to the atmosphere. A multi-media model used to predict the proportions distributed to individual media in the environment indicated that in regions where the largest quantities were estimated to have been released to the environment overall or to public water bodies or soil in particular, the predicted proportion distributed to soil was 83.2%. In regions where the largest estimated releases were to the atmosphere, the predicted proportion distributed to the atmosphere was 91.6%.

The maximum expected concentration of exposure to humans via inhalation, based on general environmental atmospheric data, was around 0.3 μg/m^3. A maximum detected level of 0.28 μg/m^3 was reported in a study of general environmental atmospheric data for a limited area. In addition, the maximum expected concentration of exposure for indoor air was around 2 μg/m^3. The mean annual value for atmospheric concentration in fiscal 2010 was calculated by using a plume-puff model on the basis of reported releases to the atmosphere according to the PRTR Law; this model predicted a maximum level of 9.6 μg/m^3.

The maximum expected oral exposure was estimated to be generally less than 0.00032 μg/kg/day on the basis of calculations from data for public freshwater bodies. Note that albeit past data forpublic freshwater bodies, the maximum expected exposure calculated from data for food was around less than 4 μg/kg/day. When reported releases to public freshwater bodies in fiscal 2010 according to the PRTR Law were divided by the ordinary water discharge of the national river channel structure database, estimating the concentration in rivers while taking into consideration only dilution gave a maximum value of 0.17 μg/L. Using this estimated concentration for rivers to calculate oral exposure gave 0.0068 μg/kg/day.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was

generally less than 0.008 μg/L for both public freshwater bodies and seawater. The maximum river concentration was estimated to be 0.17 μg/L from reported releases to public freshwater bodies under the PRTR Law.

3.Initial assessment of health risk

This substance may cause irritation to eyes, skin and respiratory tract. Contact of the substance with skin may make it red, while its contact with eyes may cause redness and pain. When inhaled, coughing, sore throat, headache, lethargy, shortness of breath and loss of consciousness may occur, while nausea and vomiting may be caused when ingested. This substance may also cause skin sensitization. LCLo of the substance for human has been reported to be 60 mg/m^3 or 510 mg/m^3. In addition, it has been reported that its exposure in a concentration of 250 mg/m^3 may lead to mucosal irritation while dizziness, drowsiness and disturbance of consciousness may be caused by its exposure in 50 to 100 mg/m^3 for 20 to 90 minutes.

As sufficient information was not available to evaluate carcinogenic potential of the substance, an initial assessment was conducted on the basis of information on its non-carcinogenic effects.

With regard to oral exposure to the substance, a NOAEL of 5 mg/kg/day (for increased relative kidney weight) was identified to be the reliable lowest dose of the substance as its 'non-toxic level*'. With regard to inhalation exposure to the substance, a NOAEL of 102 mg/m^3 (for degeneration and atrophy of the olfactory epithelium, basal cell hyperplasia, etc.) obtained from its mid-term and long-term toxicity tests on rats was adjusted for their durations to provide 18 mg/m^3 for its intermittent to continuous exposure. This value was identified to be the reliable lowest dose of the substance as its 'non-toxic level*'.

As for oral exposure to the substance, its maximum exposure concentration would be below 0.00032 μg/kg/day, when intakes of freshwater from public water bodies were assumed. The MOE would be above 1,600,000 when calculated from its 'non-toxic level*' of 5 mg/kg/day and its maximum exposure concentration predicted from animal experiments, and divided by a factor of 10 to convert animal data to human. In addition, as for oral exposure to this substance, its maximum exposure level was estimated to be below 4 μg/kg/day from historical data on its exposure through food (reported in FY 2001). The MOE would be above 130 when calculated from this value as its reference. The maximum exposure level was calculated to be 0.0068 μg/kg/day from concentrations of the substance in river water with effluents from operators discharging it in high concentrations, reported in FY 2010 under the PRTR Law. The MOE would be 74,000 when calculated from this value. Therefore, no further action would be required at this moment to assess health risk from its oral exposure.

With regard to inhalation exposure to the substance, its maximum exposure concentration in the ambient air was predicted to be approximately 0.3 μg/m^3. The MOE would be 6,000 when calculated from its 'non-toxic level*' of 18 mg/m^3 and its maximum exposure concentration predicted from animal experiments, and divided by a factor of 10 to convert animal data to human. Its maximum (annual mean) concentration in the ambient air near operators with its emissions in high concentrations was calculated to be 9.6 μg/m^3 from its emissions reported in FY 2010 under the PRTR Law. The MOE would be 190 when calculated from this value as its reference. As for its concentrations in the indoor air, the MOE would be 900 when calculated from its maximum exposure concentration predicted to be approximately 2 μg/m^3. Therefore, no further action would be required at this moment to assess health risk from its inhalation exposure both in the ambient air and in the indoor air.

Toxicity				Exposure assessment		Result of risk assessment			Judgment
Exposure Path	Criteria for risk assessment	Animal	Criteria for diagnoses (endpoint)	Exposure medium	Predicted maximum exposure dose and concentration				
Oral	'Non-toxic level*' 5 mg/kg/day	Rat	Increased relative kidney weight	Drinking water	— μg/kg/day	MOE	—	×	○
				Freshwater	< 0.00032 μg/kg/day	MOE	> 1,600,000	○	
Inhalation	'Non-toxic level*' 18 mg/m^3	Rat	Degeneration and atrophy of the olfactory epithelium, basal cell hyperplasia, etc.	Ambient air	0.3 μg/m^3	MOE	6,000	○	○
				Indoor air	2 μg/m^3	MOE	900	○	

Non-toxic level *

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

・When an adverse effect level for the short-term exposure is available, 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 EC_{50} in excess of 86,300 µg/L for growth inhibition in the green alga *Pseudokirchneriella subcapitata*, a 48-h EC_{50} of 83,800 µg/L for swimming inhibition in the crustacean *Daphnia magna*, a 96-h LC_{50} of 191,000 µg/L for the fish species *Lepomis macrochirus* (bluegill), and a 40-h IGC_{50} of 2,200,000 µg/L for reproductive inhibition in the ciliate protozoa *Tetrahymena pyriformis*. Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 840 µg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 86,300 µg/L for growth inhibition in the green alga *P. subcapitata*, and a 21-d NOEC of 3,530 µg/L for reproductive inhibition in the crustacean *D. magna*. Accordingly, based on these chronic toxicity values and an assessment factor of 100, a PNEC of 35 µg/L was obtained.

The value of 35 µg/L obtained from the chronic toxicity to the crustacean was used as the PNEC for this substance.

The PEC/PNEC ratio was less than 0.0002 for both freshwater bodies and seawater. The maximum river concentration was estimated to be 0.17 µg/L from reported releases under the PRTR Law, and the ratio of this value to the PNEC is less than 0.1. Accordingly, further work on this substance is considered unnecessary at this time.

Hazard assessment (basis for PNEC)			Assessment factor	Predicted no effect concentration PNEC (µg/L)	Exposure assessment		PEC/PNEC ratio	Judgment based on PEC/PNEC ratio	Assessment result
Species	Acute/ chronic	Endpoint			Water body	Predicted environmental concentration PEC (µg/L)			
Crustacean *Daphnia magna*	Chronic	NOEC Reproductive inhibition	100	35	Freshwater	<0.008	<0.0002	○	○
					Seawater	<0.008	<0.0002		

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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 of further work at present.		○

［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.