21	CAS No.: 78-93-3	Substance: Methyl ethyl ketone

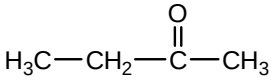
Chemical Substances Control Law Reference No.: 2-542(Alkyl (C 1 - 16) methyl ketone)

PRTR Law Cabinet Order No.:

Molecular Formula: C_4H_8O

Molecular Weight: 72.11

Structural Formula:



1. General information

The aqueous solubility of this substance is 2.23 x 10^5 mg/L (25°C) and the partition coefficient (1-octanol / water) (log Kow) is 0.29. The vapor pressure is 95.3 mmHg (= 1.27 x 10^4 Pa) (25°C). Degradability (aerobic degradation) in terms of BOD-based degradation percentage is estimated to be 83%. This substance does not have hydrolyzable groups.

It is mainly used for cellulose nitrate, various synthetic resins, lacquer solvents, additives, printing ink, synthetic leather, solvents for refining lubricant, vulcanization accelerators, synthetic raw materials, and detergents. This substance is released from jet and internal combustion engines and industry activities such as coal gasification and is also contained in cigarette smoke. This substance and other carbonyl compounds are photosynthetically generated from free radicals and the volume generated is sometimes much more than those of artificial releases. The substance is generated biologically and confirmed as a metabolite of microorganisms. It is widely detected in higher plants, insect pheromones, animal tissues, and blood, urine, and exhaled breath of human. Production of this substance in FY2005 came to 280,607 tons. The export quantity was 132,699 tons and the import quantity was 1,495 tons.

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2. Exposure assessment

As methyl ethyl ketone is not 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), no information on release and transfer quantities could be obtained. When predictions of distribution ratios by medium were made using the Mackay-Type Level III Fugacity Model, in the event of equal release to the atmosphere, water and soil, the distribution ratio was highest for soil and water.

Based on previous data for the ambient air, the predicted maximum exposure concentration for inhalation exposure to human beings was approximately 14 μg/m^3. The expected maximum concentration in the indoor air was 200 μg/m^3. The highest estimated oral exposure level was calculated at approximately 0.064 μg/kg/day from the previous data on public freshwater bodies. The risk of exposure to this substance through food in environmental media is considered to be low.

The previous data of predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was estimated to be approximately 1.6 μg/L for freshwater and approximately 1.5 μg/L seawater public water bodies.

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3. Initial assessment of health risk

The substance is irritating to the eyes, the skin and respiratory tract. The substance may cause effects on the central nervous system. Contact with the eyes may cause redness and pain. By inhalation or ingestion, it may cause cough, dizziness, drowsiness, headache, nausea and vomiting. Additionally, by ingestion, it may cause unconsciousness. There is a report that determined a lethal dose lowest (LDL_0) for humans to be 714.3 mg/kg.

There was insufficient information regarding the carcinogenicity of the substance. For this reason, an initial assessment of the substance was conducted based on information of non-carcinogenic effects.

For oral exposure, the 'Non-toxic level*' could not be estimated. A no observed adverse effect level (NOAEL) for the inhalation exposure of 1,010 ppm (low body weight in fetuses, skeletal variation of fetuses) was obtained from the reproductive or developmental toxicity testing for mice. The NOAEL was adjusted to 295 ppm (870 mg/m^3) taking into account the exposure situations, and the value was derived as the 'Non-toxic level*'. Concerning oral exposure, because

its 'Non-toxic level*' is not determined, its health risk can not be identified.

For reference, the margin of exposure (MOE) based on the information on 2-butanol(2-OL), one of metabolites of this substance, was estimated to be 26,000. 'Non-toxic level*' for inhalation exposure was converted to obtain 'non-toxic level' of 261 mg/kg/day for oral exposure, and then this 261 mg/kg/day was divided by the predicted maximum dose to produce the MOE of 410,000. These figures estimated for reference are high enough that the MOE of this substance would not be lower than 100, should the 'Non-toxic level*' of this substance be 100 times higher than that of 2OL. Furthermore, as the exposure to this substance through food intakes was estimated minor, even when the exposure through freshwater and food are combined, it would not greatly affect the MOE values. Accordingly, further action for assessment of its health risk from oral exposure to this substance would not be required at present.

For inhalation exposure to this substance in the ambient air was considered, the predicted maximum exposure concentration was approximately 14 μg/m^3. The MOE of 6,200 was derived from the 'Non-toxic level*' of 870 mg/m^3 divided by the predicted maximum exposure concentration, and divided by 10 because the 'Non-toxic level*' was established by means of animal testing. For inhalation exposure to this substance in the indoor air, the predicted maximum exposure concentration was 200 μg/m^3. Accordingly, from the 'Non-toxic level*' of 870 mg/m^3 and the predicted maximum exposure concentration, the MOE of 440 was determined in the same way. Accordingly, further action would not be required at present for assessment of its health risk with regard to inhalation exposure to this substance in the ambient and the indoor 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*' — mg/kg/day	—	—	Drinking water	— μg/kg/day	MOE	—	×	(○)
				Freshwater	0.064 μg/kg/day	MOE	—	×	
Inhalation	'Non-toxic level*' 870 mg/m^3	Mice	low body weight in fetuses, skeletal variation of fetuses	Ambient air	14 μg/m^3	MOE	6,200	○	○
				Indoor air	200 μg/m^3	MOE	440	○	○

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 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, reliable information of a 72-hour median effective concentration (EC_{50}) growth inhibition value exceeding 1,196,000 μg/L was found for the algae *Pseudokirchneriella subcapitata*, a 48-hour EC_{50} immobilization value exceeding 1,000,000 μg/L was found for the crustacea *Daphnia magna* (water flea), and a 96-hour median lethal concentration (LC_{50}) exceeding 100,000 μg/L was found for the fish *Oryzias latipes* (medaka). Accordingly, an assessment factor of 100 was used, and a predicted no effect concentration (PNEC) exceeding 1,000 μg/L was obtained based on the acute toxicity values. With regard to chronic toxicity, reliable information of a 72-hour no observed effect concentration (NOEC) growth inhibition value of 92,900 μg/L was found for the algae *P. subcapitata*, and a 21-day NOEC reproduction value exceeding 100,000 μg/L was found for the crustacea *D. magna*. Accordingly, an assessment factor of 100 was used, and a PNEC value of 930 μg/L was obtained based on the chronic toxicity values. As the PNEC value for the substance, a value of 930 μg/L obtained from the chronic toxicity for the algae, was used.

The PEC/PNEC ratio was 0.002 for both freshwater bodies and seawater bodies. 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 assessment body	Predicted environmental concentration PEC (μg/L)		
Algae (green algae)	Chronic	NOEC growth inhibition	100	930	Freshwater	1.6	0.002	○
					Seawater	1.5	0.002	

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	Risk cannot be identified. However, there would be little necessity of collecting information.	(○)
	Inhalation exposure	Further work would not be required at the moment to assess its health risk for its inhalation exposure in the ambient and indoor air.	○
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.