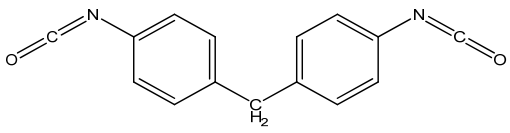
9	CAS No.: 101-68-8	Substance: Methylenebis(4,1-phenylene) diisocyanate

Chemical Substances Control Law Reference No.: 4-118（diphenylmethane diisocyanate）
PRTR Law Cabinet Order No. 1-448（number after law revision*：1-498）

Molecular Formula: $_{15}H_{10}N_2O_2$

Molecular Weight: 250.25

Structural Formula:



1. General information

The aqueous solubility and partition coefficient (1-octanol/water) (log K_{ow}) of this substance could not be estimated based on calculations using a model because this substance hydrolyzes. The vapor pressure is 6.7×10^{-4} Pa (25℃). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 0%. In addition, polymeric MDI (54.5% dimeric MDI, 32.4% trimeric MDI) reacts with water to form primarily solid insoluble polyurea with a small quantity of 4,4'-methylenedianiline (MDA) also formed.

This substance is designated as a Priority Assessment Chemical Substance from the perspective of effects on human health. In addition, it is classified as a Class 1 Designated Chemical Substance under the PRTR Law.

The main use of this substance is as a raw material for adhesives, paints, spandex fibers, synthetic leather, and urethane elastomers. The production and import quantity in fiscal 2019 was less than 39,315 t. The production and import category under the PRTR Law was more than 100 t.

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2. Exposure assessment

Total release to the environment in fiscal 2019 under the PRTR Law was approximately 2.5 t, of which approximately 1.1 t or 43% of overall releases were reported. The majority of reported releases were to the atmosphere. In addition, approximately 889 t was transferred to waste materials and 0.0002 t was transferred to sewage. The plastic products manufacturing industry, the transportation equipment manufacturing industry, and the electrical machinery manufacturing industry were the main reporters of releases to the atmosphere, while the rubber product manufacturing industry reported releases to public water bodies. The majority of releases including unnotified ones were to the atmosphere.

The proportions distributed to individual media were not predicted for this substance because the physico-chemical properties required for such an analysis could not be obtained.

The maximum expected concentration of exposure to humans via inhalation, based on ambient atmospheric data, was less than around 0.00054 μg/m^3. Further, the mean annual value for atmospheric concentration in fiscal 2019 was calculated by use of a plume-puff model on the basis of releases to the atmosphere reported under the PRTR Law: this model predicts a maximum level of 0.14 μg/m^3.

An oral exposure assessment was not carried out for this substance because it breaks down spontaneously upon coming into contact with water and oral exposure is thereby deemed impossible.

While there are reports of releases of this substance to public water bodies, it breaks down spontaneously upon coming into contact with water and exposure to aquatic organisms in water is considered highly unlikely. On this account, concentrations in rivers were not measured.

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3. Initial assessment of health risk

This substance causes lachrymation and irritates the eyes, the skin, as well as the respiratory tract. The substance may affect the lungs, resulting in impaired functions. Inhalation will cause headaches, nausea, shortness of breath, and sore throat. Contact to the skin will cause redness. Contact to the eyes will cause pain.

Since not enough information was available on the carcinogenicity of the substance, the initial assessment was conducted based on information on its non-carcinogenic effects.

The 'non-toxic level' for oral exposure could not be identified. The NOAEL of 0.19 mg/m^3 for inhalation exposure (based on interstitial fibrosis in the lungs, bronchioloalveolar hyperplasia, etc.), determined from toxicity tests in rats, was adjusted according to exposure conditions. The obtained value of 0.034 mg/m^3 was deemed to be the lowest reliable concentration and was identified as the 'non-toxic level' of the substance for inhalation exposure.

Regarding oral exposure, due to the lack of identified 'non-toxic level' and exposure levels, the health risk could not be assessed. In consideration of the high hydrolyzability and the PRTR data of this substance, humans are not likely to be exposed to this substance in environmental media by ingestion. Therefore, as a comprehensive judgment, the collection of further information would not be required to assess the health risk of this substance via oral exposure.

Regarding inhalation exposure, the predicted maximum exposure concentration in ambient air was less than 0.00054 μg/m^3, approximately. The MOE (Margin of Exposure) would exceed 6,300 which is calculated from the predicted maximum exposure concentration and the 'non-toxic level' of 0.034 mg/m^3, and subsequently divided by a factor of 10 to account for extrapolation from animals to humans. This would lead to the health risk judgment that no further work would be required at present. However, the MOE for reference would be 24 which is calculated from the maximum concentration (annual mean) of 0.14 μg/m^3 in ambient air near the operators that are releasing a large amount of the substance based on the releases to air reported in FY 2019 under the PRTR Law. Therefore, as a comprehensive judgment, the collection of information would be required to assess the health risk of this substance via inhalation in ambient air, starting from data on the concentrations in ambient air near the operators that are releasing a large amount of the substance.

Toxicity				Exposure assessment		MOE		Comprehensive judgment
Exposure Path	Criteria for risk assessment	Animal	Criteria for diagnoses (endpoint)	Exposure medium	Predicted maximum exposure dose and concentration			
Oral	'Non-toxic level' - mg/kg/day	-	-	Drinking water	- μg/kg/day	MOE	-	○
				Public freshwater bodies	- μg/kg/day	MOE	-	
Inhalation	'Non-toxic level' 0.034 mg/m^3	Rats	Interstitial fibrosis in lungs, bronchioloalveolar hyperplasia, etc.	Ambient air	<0.00054 μg/m^3	MOE	>6,300	▲
				Indoor air	- μg/m^3	MOE	-	×

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

The main use of this substance is as a raw material for adhesives, paints, spandex fibers, synthetic leather, and urethane elastomers. Total release to the environment reported under the PRTR Law was approximately 2.5 t, of which approximately 1.1 was released to the atmosphere, and 0.002 t was released to public water bodies. When taking into consideration this substance's rapid rate of hydrolysis and values measured in the ambient environment, the probability of its detection in public water bodies upon release to the environment is considered low.

Further, while releases to the environment from waste material containing this substance that is transferred out of businesses handling it (approximately 898 t) are unclear, based on this substance's rapid rate of hydrolysis, exposure to aquatic organisms in water is considered to be impossible under normal circumstances. Accordingly, an initial assessment of ecological risk towards aquatic organisms was not conducted. Further, among this substance's hydrolysis products 4,4'-diphenylmethanediamine (CAS No：101-77-9) has been identified as a substance for which more data needs to be collected for ecological risk assessment in the Tenth Report.

Hazard assessment (basis for PNEC)			Assessment coefficient	Predicted no effect concentration PNEC (μg/L)	Exposure assessment		PEC/ PNEC ratio	Comprehensive judgment
Species	Acute/ chronic	Endpoint			Water body	Predicted environmental concentration PEC (μg/L)		
(—)	(—)	(—)	(—)	(—)	Freshwater	(—)	(—)	(—)
					Seawater	(—)	(—)	

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work	○
	Inhalation exposure	Requiring information collection	▲
Ecological risk	Requiring information collection		(—)

［Risk judgments］○: No need for further work ▲: Requiring information collection
■: Candidates for further work ×: Impossibility of risk characterization

*Note: Number after revision of law to be implemented on April 1, 2023