10	CAS No.: 108-31-6	Substance: Maleic anhydride

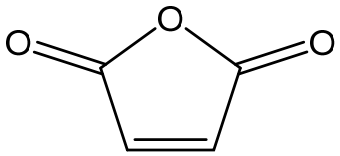
Chemical Substances Control Law Reference No.: 2-1101

PRTR Law Cabinet Order No.: 1-414

Molecular Formula: $C_4H_2O_3$

Molecular Weight: 98.06

Structural Formula:



1.General information

The aqueous solubility of this substance is 4.07×10^5 mg/L (20°C, pH=7), the partition coefficient (1-octanol/water) (log K_{ow}) is –2.61 (19.7–19.9°C), and the vapor pressure is 5×10^{-5} mmHg (=7×10^{-3} Pa) (20°C). The biodegradability (aerobic degradation) is characterized by a BOD degradation rate of 54.8%, and this substance readily hydrolyzes. Further, maleic anhydride hydrolyzes to maleic acid with a half-life in water of 22 seconds (25.1°C, pH = 7).

This substance is classified as a Class 1 Designated Chemical Substance under the PRTR Law.

The main uses of this substance are as a raw material for unsaturated polyester resins and as a resin modifier. It is also used as a raw material for succinic acid, which is used as a flavoring in rice wine, and as a raw material for fumaric acid and malic acid, which are used as acidifiers in food, as well as a raw material for surfactants, plasticizers and agricultural chemicals, and an auxiliary material for agricultural chemicals. The production and import quantity in fiscal 2019 was 82,418 t. The production and import quantity under the PRTR Law was over 100 t.

2.Exposure assessment

Total release to the environment in fiscal 2018 under the PRTR Law was approximately 5.3 t, of which approximately 3.5 t or 67% of overall releases were reported. The majority of reported releases were to the atmosphere. In addition, approximately 54 t was transferred to waste materials, and approximately 0.14 t was transferred to sewage. The chemical industry reported releases to the atmosphere, and it was the sole source of emissions to public water bodies.

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 was not established because neither data measured for the ambient atmosphere nor indoor air could be obtained. However, the mean annual value for atmospheric concentration in fiscal 2018 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 0.27 μg/m^3. Further, reduction in concentrations due to hydrolysis was not considered when estimating atmospheric concentration.

Data for potable water, ground water, public freshwater bodies, food, and soil to assess oral exposure could not be obtained. Taking into consideration the high hydrolyzability of this substance and PRTR data, etc., the likelihood of oral exposure to this substance from an environmental medium is considered is low.

Data for setting the predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, could not be obtained. Taking into consideration the high hydrolyzability of this substance and PRTR data, etc., the likelihood of exposure to aquatic organisms for this substance is considered low.

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3. Initial assessment of health risk

This substance severely irritates the eyes, skin, and respiratory tract. Inhalation of the substance will cause burning sensation, cough, sore throat, and shortness of breath and may cause asthma-like reactions. Ingestion will cause a nausea,

abdominal pain, burning sensation, vomiting and diarrhea. Contact to the skin will cause dry skin, redness, and pain. Contact to the eyes will cause redness, pain and burns.

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

The NOAEL of 10 mg/kg/day for oral exposure (based on suppression of body weight gain), determined from long-term toxicity tests in rats, was deemed to be the lowest reliable dose and was identified as the 'non-toxic level' of the substance for oral exposure. The LOAEL of 1.1 mg/m^3 for inhalation exposure (based on epithelial hyperplasia of the nasal mucosa), determined from toxicity tests in rats, was adjusted according to exposure conditions to obtain 0.20 mg/m^3 and subsequently divided by a factor of 10 to account for uncertainty in using a LOAEL, and by another factor of 10 to account for extrapolation to chronic exposure. The calculated value of 0.0020 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 the oral exposure, due to the lack of identified exposure levels, the health risk could not be assessed. However, oral exposure to this substance via environmental media seems unlikely in humans, based on the high hydrolyzability of this substance and the data reported under the PRTR Law. Therefore, as a comprehensive judgment, collection of further information would not be required to assess the health risk of this substance via oral exposure.

Regarding the inhalation exposure, due to the lack of identified exposure concentrations, the health risk could not be assessed. However, the MOE for reference would be 0.7, when calculated from the 'non-toxic level' for inhalation exposure of 0.0020 mg/m^3 and the estimated exposure concentration in ambient air of 0.27 μg/m^3, and subsequently divided by a factor of 10 to account for extrapolation from animals to the humans. This concentration in ambient air was estimated as the maximum concentration (annual mean) in ambient air, near the operators that are releasing large amount of the substance, based on the releases to air reported in FY 2018 under the PRTR Law. Therefore, as a comprehensive judgment, collection of information would be required to assess the health risk of this substance via inhalation in ambient air, starting from data on concentrations in ambient air, near the operators that are releasing large amount of this 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' 10 mg/kg/day	Rats	Suppression of body weight gain	Drinking water	- μg/kg/day	MOE	-	○
				Groundwater	- μg/kg/day	MOE	-	
Inhalation	'Non-toxic level' 0.0020 mg/m^3	Rats	Epithelial hyperplasia of the nasal mucosa	Ambient air	- μg/m^3	MOE	-	▲
				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.

4.Initial assessment of ecological risk

This substance is presumed to exist as a hydrolysis product under (aqueous) toxicity test conditions. As such, a predicted no effect concentration (PNEC) was not derived.

Data for setting this substance's PEC could not be obtained and therefore, an assessment of its ecological risk was not conducted.

Surmising that the risk of exposure to this substance from an aquatic source is exceedingly low considering its high hydrolyzability and PRTR data, etc., and the fact that it is unlikely to exist in an unhydrolyzed state in public water bodies, a comprehensive review was not conducted.

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5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work.	○
	Inhalation exposure	Requiring information collection.	▲
Ecological risk	No judgment was made.		(－)

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