14	CAS No.: 98-54-4	Substance: 4-*tert*-butylphenol

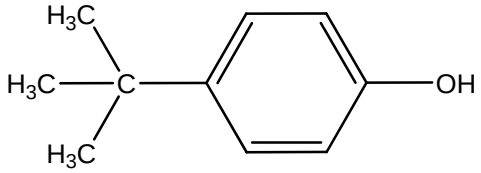
Chemical Substances Control Law Reference No.: 3-503（monoalkyl(C=3–9)phenol)

PRTR Law Cabinet Order No.: 1-368

Molecular Formula: $C_{10}H_{14}O$

Molecular Weight: 150.22

Structural Formula:



1. General information

The aqueous solubility of this substance is 580 mg/1,000 g (25°C), the partition coefficient (1-octanol/water) (log K_{ow}) is 3.31, and the vapor pressure is 0.0381 mmHg (= 5.08 Pa) (25°C). Biodegradability (aerobic degradation) is limited, and bioaccumulation is judged to be non-existent or low. Furthermore, the substance is stable towards hydrolysis (pH = 4, 7, 9; 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 uses of this substance are as a raw material for oil-soluble phenolic resins used in adhesives, printing inks, and varnishes; as a modifier for various types of synthetic resin; and as a raw material for perfumes and surfactants. The production and import quantity of monoalkyl (C=3–9) phenols in fiscal 2012 was 20,000 t. The production and import quantity in fiscal 2009 was 26,938 t. The production and import category under the PRTR Law is more than 100 t.

---

2. Exposure assessment

Total release to the environment in fiscal 2012 under the PRTR Law was approximately 0.23 t, of which approximately 0.18 t or 79% of overall releases were reported. The major destination of reported releases was the atmosphere. In addition, approximately 0.043 t was transferred to sewage and approximately 22 t was transferred to waste materials. Industry types with large reported releases were the electrical machinery and chemical industries 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 the atmosphere in particular, the predicted proportion distributed to soil was 64.3%, and that distributed to water bodies was 24.0%. In regions where the largest quantities were estimated to have been released to public water bodies, the predicted proportion distributed to water bodies was 77.6%, and that distributed to the substratum was 15.4%.

The maximum expected concentration of exposure to humans via inhalation could not be obtained. However, past data yielded a value of around 0.00057 μg/m^3 for ambient air concentration. The mean annual value for atmospheric concentration in fiscal 2012 was calculated by using a plume-puff model on the basis of releases to the atmosphere reported according to the PRTR Law; this model predicted a maximum level of 0.019 μg/m^3. The maximum expected oral exposure was estimated to be around 0.0024 μg/kg/day on the basis of calculations from data for groundwater, and around 0.0044 μg/kg/day on the basis of calculations from data for public freshwater bodies. A maximum expected oral value of around 0.0044 μg/kg/day was adopted for this substance. However, the maximum expected exposure calculated from data for public freshwater bodies and past data for food was around 0.068 μg/kg/day.

The predicted environmental concentration (PEC), which indicates exposure to aquatic organisms, was around 0.11 μg/L for public freshwater bodies and around less than 0.01 μg/L for seawater.

---

3. Initial assessment of health risk

This substance causes severe irritation to the eyes, skin and respiratory tract. The substance may affect the skin, possibly resulting in vitiligo. When inhaled, coughing and sore throat may occur, while nausea and vomiting may occur when ingested. Contact of the substance with the skin or eyes may cause redness and pain.

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

With regard to the oral exposure to the substance, the NOAEL of 70 mg/kg/day (based on inhibition of body weight gain, and adrenal gland and ovary weights increase), obtained for its mid-term and long-term toxicity tests on rats, was divided by a factor of 10 due to the short test periods. The outcome of 7 mg/kg/day was considered to be the reliable lowest dose of the substance and was identified as its 'non-toxic level*'. As for the inhalation exposure to the substance, the 'non-toxic level*' could not be identified.

Regarding the oral exposure to the substance, the predicted maximum exposure concentration was approximately 0.0004 μg/kg/day, assuming the ingestion of water from public water bodies and freshwater. The MOE (Margin of Exposure) of 160,000 was derived from the substance's 'non-toxic level*' of 7 mg/kg/day and the predicted maximum exposure concentration, and after the division by a factor of 10 to convert animal data to human data. In addition, the MOE of 10,000 was derived from the maximum exposure level of 0.068 μg/kg/day, based itself on the data on exposure through food intake (reported in 2003). Therefore, no further action would be required at present to assess the health risk for the oral exposure to this substance.

Concerning the inhalation exposure to the substance, the health risk could not be assessed as the 'non-toxic level*' could not be established, nor the exposure concentrations. In addition, assuming a 100 % absorption, and converting the 'non-toxic level*' for the oral exposure to the inhalation one, the 'non-toxic level*' would be 23 mg/m^3. The MOE of 4,000,000 was derived from this level and the maximum concentration in ambient air of 0.00057 $\mu g/m^3$, reported as a historical data, and after the division by a factor of 10 to convert animal data to human data. Moreover, the MOE of 120,000 was derived from the maximum atmospheric concentration in the high discharging plants area of 0.019$\mu g/m^3$, calculated from the reported emissions in the atmosphere in FY 2012 under the PRTR Law and after the division by a factor of 10 to convert animal data to human data. Therefore, collection of information would not be required to assess the health risk for the inhalation exposure to this substance in ambient 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*' 7 mg/kg/day	Rat	Inhibition of body weight gain, and adrenal gland and ovary weights increase	Drinking water	– μg/kg/day	MOE	–	×	○
				Freshwater	0.0044 μg/kg/day	MOE	160,000	○	
Inhalation	'Non-toxic level*' – mg/m^3	–	–	Ambient air	– $\mu g/m^3$	MOE	–	×	(○)
				Indoor air	– $\mu g/m^3$	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

With regard to acute toxicity, the following reliable data were obtained: a 72-h EC_{50} of 14,000 μg/L for growth inhibition in the green alga *Pseudokirchneriella subcapitata*, a 48-h EC_{50} of 3,900 μg/L for swimming

inhibition in the crustacean *Daphnia magna*, a 96-h LC_{50} of 5,100 µg/L for the fish species *Oryzias latipes* (medaka), and a 24-h LC_{50} of 10,200 µg/L in the frog species *Rana japonica* (Japanese brown frog). Accordingly, based on these acute toxicity values and an assessment factor of 100, a predicted no effect concentration (PNEC) of 39 µg/L was obtained.

With regard to chronic toxicity, the following reliable data were obtained: a 72-h NOEC of 320 µg/L for growth inhibition in the green alga *P. subcapitata*, and a 21-d NOEC of 730 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 3.2 µg/L was obtained.

The value of 3.2 µg/L obtained from the chronic toxicity to the alga was used as the PNEC for this substance.

The PEC/PNEC ratio is 0.03 for freshwater bodies and less than 0.003 for seawater; accordingly, further work is considered unnecessary at this time.

Hazard Assessment（Basis for PNEC）			Assessment Coefficient	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)			
Green algae	Chronic	NOEC growth inhibition	100	3.2	Freshwater	0.11	0.03	○	○
					Seawater	<0.01	<0.003		

---

5. Conclusions

	Conclusions		Judgment
Health risk	Oral exposure	No need for further work at present.	○
	Inhalation exposure	Although risk to human health could not be confirmed, collection of further information would not be required.	(○)
Ecological risk	No need for further work at present.		○

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

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

（○）: Although risk to human health could not be confirmed, collection of further information would not be required.

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