CATECHOL

CAS number: 120-80-9

Synonyms: 1,2-benzenediol, 1,2-dihydroxybenzene, pyrocatechol, o-dihydroxybenzene, catechine, pyrocatechine

Chemical formula: $C_6H_6O_2$

Workplace exposure standard (interim)

TWA: **0.05 ppm (0.2 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **—**

IDLH: **Carc. 2., Sk., DSEN**

Sampling and analysis: There is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.05 ppm (0.2 mg/m^3) is recommended to minimise the risk of cancer in exposed workers.

Given the limited data available from the primary sources and uncertainty surrounding the mechanism of action for carcinogenicity, a review of additional sources is recommended as a priority at the next scheduled review.

Discussion and conclusions

Catechol is used as an antioxidant in several industries and in cosmetics, pharmaceuticals, insecticides and inks.

Toxicological data are limited and no human exposure data are currently available. Evidence in animals suggests carcinogenic properties. There is enough evidence to classify the chemical as mutagenic and it is considered a non-threshold based genotoxic carcinogen (HCOTN, 2011; NICNAS, 2014). Its carcinogenicity is demonstrated to act *via* a mutagenic mode of action.

At present, insufficient data are available to determine a health-based TWA. Therefore, an interim TWA has been derived by applying a safety factor of 100 to the current TWA to account for carcinogenicity potential. The recommended TWA is also considered to protect against eye and respiratory tract irritation and dermatitis in exposed workers.

Recommendation for notations

Classified as a category 2 carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser and not a respiratory sensitiser according to the GHS.

A skin notation is recommended as evidence indicates rapid absorption through the skin leading to acute poisonings in the workplace.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 5 ppm (23 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 5 ppm (23 mg/m^3)***
TLV-TWA recommended to minimise the risk of ocular and respiratory tract irritation and dermatitis. TLV-TWA recommendation primarily by analogy to Phenol due to its action. Assigned an A3, Confirmed Animal Carcinogen with Unknown Relevance to Humans. Summary of data: Human data: • Anecdotal evidence of dermal absorption producing dermatitis and symptoms similar to phenol exposure with more pronounced CNS effects (convulsions) • Workers exposed to 2–72 ppm for 2 yr complained of sore throat, cough and eye irritation and presented greater that average incidents of skin disorders than the control population (no further information). Animal Data: • LD_{50}: 300 mg/kg (rats, oral) • No visible effects reported at 1,500 mg/m^3 (rats, 8 h) • Eye and nasal irritation, loss of coordination, muscle spasms and tremors at 2,800 mg/m^3 (rats, 8 h) • Erythema and oedema of intact skin and necrosis on abraded skin reported following application of 500 mg dose (rabbits 24 h) • Determined to be a co-carcinogen with Benzo[a]pyrene in mouse skin painting studies.		
DFG	***NA***	***NA***
No report.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2011***	***Not assigned***
Summary of additional data: Carcinogenicity: • Mice exposed at 0 or 2,000 µg (3/wk for 64–80 wk, dermal), no skin tumours were observed in any of the animals. Genotoxicity: *In Vitro*: • Positive in *Escherichia coli* strain in the absence of metabolic activation system • Induced apoptosis in human glioblastoma GL-15 cells (Comet assay).		

Source	Year set	Standard
Mechanism of action: • A common hypothesis is that pyrocatechol induces oxidative DNA damage • It cannot be excluded that pyrocatechol may exert its carcinogenic effect by its irritating potency, a non-genotoxic mechanism.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2014	• Sufficient evidence to classify the chemical as causing possible mutagenic effects • Appears genotoxic in several *in vitro* and *in vivo* assays, however mode of tumour induction not fully explained • Critical effects stated to be carcinogenicity, mutagenicity and skin sensitisation (oral & dermal) with acute skin and eye irritation effects.
IARC	✓	1977	• Shown to cause gene mutations in mammalian cells *in vitro* • After application to mice, negative in one and positive in 3 studies of micronucleus formation in bone marrow. • Evidence of dermal absorption producing dermatitis and symptoms similar to phenol exposure.
ECHA	✓	2016	• No further information.
OECD	✓	2003	• LD_{50}: 600 mg/kg (rats, dermal) • Possesses irritant, skin sensitising, anti-oxidant, mutagenic and carcinogenic properties (at high doses) • Possibly a developmental toxicant.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	Yes
Is the chemical carcinogenic with a mutagenic mechanism of action?	Yes
The chemical is a non-threshold based genotoxic carcinogen.	
Is a cancer slope factor or inhalation unit risk value available?	No

Notations

Source	Notations
SWA	NA
HCIS	Carcinogenicity – category 2, Skin sensitisation – category 1
NICNAS	Carc. Cat. 3
EU Annex	NA
ECHA	NA
ACGIH	Carcinogenicity – A3, Skin

Source	Notations
DFG	NA
SCOEL	NA
HCOTN	Carcinogenicity – category 1B
IARC	Carcinogenicity – Group 2B
US NIOSH	SK:SYS, SK:SEN

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

Skin notation assessment

Calculation	
Adverse effects in human case study:	yes
Dermal LD_{50} ≤1000 mg/kg:	
Dermal repeat-dose NOAEL ≤200 mg/kg:	
Dermal LD_{50}/Inhalation LD_{50} <10:	
In vivo dermal absorption rate >10%:	
Estimated dermal exposure at WES >10%:	
	a skin notation is warranted

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	110.11
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m^3; 1 mg/m^3 = Click or tap here to enter text. ppm
This chemical is used as a pesticide:	✓
This chemical is a biological product:	☐
This chemical is a by-product of a process:	☐
A biological exposure index has been recommended by these agencies:	☐ ACGIH ☐ DFG ☐ SCOEL

Workplace exposure standard history

Year	Standard
Click here to enter year	

References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the *TLVs® and BEIs® Guidelines section* on the ACGIH website.

Health Council of the Netherlands (HCOTN) (2011) 1,2-Catechol (pyrocatechol). Evaluation of the carcinogenicity and genotoxicity. The Hague: Health Council of the Netherlands; publication no. 2011/05OSH.

International Agency for Research on Cancer (IARC) (1999) Volume 71 re-evaluation of some organic chemicals, hydrazine and hydrogen peroxide. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) 1,2-Benzenediol: Human health tier II assessment – IMAP report.

Organisation for Economic Cooperation and Development (OECD) (2003) SIDS initial assessment profile – Catechol.

US National Institute for Occupational Safety and Health (NIOSH) (2019) Skin Notation Profiles: Catechol.