METHYL ACRYLATE

CAS number:	96-33-3
Synonyms:	Acrylic acid methyl ester, methyl propenoate, methyl-2-propenoate, methyl prop-2-enoate, methoxycarbonylethylene, propenoic acid methyl ester, 2-propenoic acid methyl ester
Chemical formula:	$C_4H_6O_2$
Structural formula:	—

Workplace exposure standard (amended)

TWA:	**2 ppm (7 mg/m^3)**
STEL:	—
Peak limitation:	—
Notations:	**Sk., DSEN**
IDLH:	**250 ppm**

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 2 ppm (7 mg/m^3) is recommended to protect for irritation to the eyes, skin and respiratory system in exposed workers.

Discussion and conclusions

Methyl acrylate is used as a co-monomer with acrylonitrile in the production of acrylic and modacrylic fibre, in paint rollers, battery separators and protective clothing.

The critical effects of exposure are irritation to the eyes, skin and respiratory system. While limited human data are available, experimental data indicate it is a moderate irritant. Increased irritation of the eyes associated with increasing concentrations above an average of 2 ppm reported in ten workers over a 12-hour shift. A NOAEC 15 ppm, with reversible irritation of the nasal mucosa and cornea at higher concentrations, was reported in a two-year inhalation study in rats (ACGIH, 2018). In a different two-year inhalation study, a LOAEC of 15 ppm is reported in rats for effects on the olfactory and respiratory epithelium. A benchmark dose of 6.8 ppm for males was calculated from this study (DFG, 2016).

Based on the weight of evidence, a TWA of 2 ppm (7 mg/m^3) is recommended as assigned by ACGIH (2018) and DFG (2016). This TWA is cited to be protective of irritation effects in exposed workers.

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

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

A skin notation is recommended based on evidence suggesting rapid dermal absorption resulting systemic burden in animals (DFG, 2016; NICNAS, 2019).

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 10 ppm (35 mg/m^3)***
Sourced from ACGIH recommendation; ACGIH subsequently reviewed their recommendation and reduced the value.		
ACGIH	***2014***	***TLV-TWA: 2 ppm (7 mg/m^3)***

TLV-TWA recommended to minimise the potential for acute and chronic irritation of the eyes, skin, and mucous membranes.
Summary of data:
Human data:
• Experimental data indicates skin sensitisation and a moderate irritant
• Short-term study in 10 workers exposed at a TWA of 2–5 ppm reported eye irritation in some:
  ○ irritation increased in those with higher exposures
  ○ increased bronchial reactivity in a previously unexposed worker after exposure.
Animal data:
• 2-yr inhalation study in rats; 6 h/d, 5 d/wk, whole-body inhalation chambers at 0, 15, 45, or 135 ppm:
  ○ NOEL of 15 ppm; reversible irritation of the nasal mucosa and cornea at 15 ppm
• Statistically significant increases in benign hypophyseal tumours both sexes; epithelial and leukemic neoplasms found in the male rats; no dose-response relationship identified. No further information
• Dermal LD_{50}: 1,243 mg/kg, rabbits; 1,300 mg/kg, rats
• Skin notation warranted based on significant dermal absorption and distribution by treated guinea pigs
• Skin sensitisation in guinea pigs
 	
Insufficient data to recommend a respiratory sensitiser notation or TLV-STEL.		

Source	Year set	Standard
DFG	***2016***	***MAK: 2 ppm (7.1 mg/m^3)***
MAK is recommended to protect against effects on the olfactory and respiratory epithelium as demonstrated in rats. Summary of addition data: • NOAEC of 5 ppm reported in a 2-generation inhalational study; daily exposure in males for 12 wk, in females 4.5 mo; reserve cell hyperplasia with the loss of cilia and olfactory cells, degeneration with regeneration of the olfactory epithelium, hyperplasia of the transitional epithelium and hyperplasia and hypertrophy of the goblet cells in the respiratory epithelium of rats • LOAEC of 15 ppm in 2-yr inhalation study in rats; effects on the olfactory and respiratory epithelium; $BMDL_{05}$ of 6.8 ppm for males calculated (same as ACGIH) • MAK 2 ppm derived from $BMDL_{05}$ of 6.8 ppm adjusted by 1:3 to account for rats to human variation. • Skin notation: o modelled dermal absorption in humans of 1,670 mg assuming 1 h exposure of 2,000 cm^2 skin o reported a systemic NOAEC of 135 ppm from 2 yr study in rats equates to dose of 1,205 mg o estimated skin absorption of >25% of systemic tolerable dose justifying skin notation.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***NA***	***NA***
No report.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2014	• Positive results for sensitisation in patch tests in humans • NOEC of 23 ppm for local effects; 12-wk, 6 h/d, 5 d/wk; irritation of the mucosa and haemorrhagic discharge from the eyes and nose.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	No

The chemical is not a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	Skin:Sen
HCIS	Skin sensitisation – category 1
NICNAS	Skin sensitisation
EU Annex	NA
ECHA	Skin Sens. 1
ACGIH	Carcinogenicity – A4, DSEN, Skin
DFG	Sh (dermal sensitiser), H (skin)
SCOEL	NA
HCOTN	NA
IARC	Carcinogenicity – Group 2B
US NIOSH	NA

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	
Conclusion:	
Adverse effects in human case study:	
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%:	yes
Estimated dermal exposure at WES >10%:	
	consider assigning a skin notation

IDLH

Is there a suitable IDLH value available?	Yes

Additional information

Molecular weight:	86.09
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 3.52 mg/m^3; 1 mg/m^3 = 0.28 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.

Deutsche Forschungsgemeinschaft (DFG) (2017) Methyl acrylate – MAK value documentation.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

International Agency for Research on Cancer (IARC) Re-evaluation of some organic chemicals, hydrazine and hydrogen peroxide. IARC Monographs –71.

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

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Methyl acrylate.