



THIOGLYCOLIC ACID

CAS number: 68-11-1

Synonyms: Mercaptoacetic acid, thiovanic acid

Chemical formula: $C_2H_4O_2S$

Workplace exposure standard (retained)

TWA: 1 ppm (3.8 mg/m³)

STEL: —

Peak limitation: —

Notations: Sk., DSEN

IDLH: —

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

Recommendation and basis for workplace exposure standard

A TWA of 1 ppm (3.8 mg/m³) is recommended to protect for irritation of the eyes and skin in exposed workers.

Discussion and conclusions

Thioglycolic acid is used in hair care products, as pharmaceuticals and process intermediates and thioglycolates are used in bacteriology.

The critical effects of exposure are corrosion and irritation of the skin and eyes.

There are limited data relating to the acid and more available relating to ammonium and sodium salts. There are reports of the ammonium and sodium salts causing skin lesions of neck, ears and shoulders following permanent hair waving and rare cases of contact eczema of hands and arms in hairdressers (ACGIH, 2018). A NOAEL of 20 mg/kg/day reported for changes in blood biochemistry and microscopic histopathological changes in the liver in a 90-day gavage study of the sodium salt in rats (ACGIH, 2018; ECHA, 2011; NICNAS, 2013; OECD, 2009). Due to (reversible) inhibition of β -oxidation of fatty acids in the same study, 7 mg/kg/day is regarded as the NOAEL by DFG (2012).

Based on the weight of evidence, the NOAEL of 20 mg/kg/day in rats is used as the most appropriate point of departure and a TWA of 1 ppm (3.8 mg/m³) is recommended to be retained as assigned by ACGIH (2018). Although the derivation of this concentration is not detailed, ACGIH stated this being sufficiently low to protect for irritant effects.

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 as evidence indicates rapid absorption through the skin and adverse systemic effects in animals.

DRAFT

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 1 ppm (3.8 mg/m³)
ACGIH	2018	TLV-TWA: 1 ppm (3.8 mg/m³)
<p>TLV-TWA recommended to minimise respiratory and eye irritation.</p> <p>Summary of data:</p> <p>Derivation of the TWA is not provided.</p> <p>Human data:</p> <ul style="list-style-type: none"> Expected to cause irritation of eyes, skin or respiratory tract due to acidic nature NH₄ and Na salts of the acid reportedly cause skin lesions of neck, ears and shoulders following permanent hair waving Contact with NH₄ salt causes allergic contact dermatitis: <ul style="list-style-type: none"> rare cases of contact eczema of hands and arms in hairdressers Patch testing of volunteers with concentrations up to 11% (not neutralised) for 1–96 h, abraded and unabraded skin: <ul style="list-style-type: none"> caused irritation at 2.8% or higher most irritating to abraded skin 4.6% aqueous solution caused irritation in volunteers after 4–6 h Repeated applications of NH₄ salt in healthy humans at 14.6–18% in aqueous solution caused significant skin irritation and low level allergic contact dermatitis Second degree burns of skin following accidental exposure to eye, face, legs and arms: <ul style="list-style-type: none"> lead to clouding of cornea; outcome not provided. <p>Animal data:</p> <ul style="list-style-type: none"> Oral LD₅₀: 114 mg/kg (rat); 242 mg/kg (mice); 119 mg/kg (rabbit); 126 mg/kg (guinea pig) Severely corrosive to rabbit eye Dermal LD₅₀: 47 mg/kg (mice); 848 mg/kg (rabbit) Single dermal application patch produced necrosis in rabbit skin in 5 min, with local hyperaemia Repeated exposure causes skin sensitisation (with acid and its salts) 4 h LC₅₀: 56 ppm (210 mg/m³) (rats, whole body exposure): <ul style="list-style-type: none"> all rats survived at 18 ppm (68 mg/m³); clinical signs: abnormal respiration, lung congestion, increased lung weight In LLNA NH₄ salt in acetone/water/olive oil strongly sensitising in mice Na salt administered <i>via</i> dermal route at 0, 11.25, 22.5, 45, 90 or 180 mg/kg/d in rats and 0, 22.5, 45, 90, 180 or 360 mg/kg/d in mice, 5 d/wk for 13 wk: <ul style="list-style-type: none"> skin irritation at application site only treatment related effect LOEL 11.25 and 45 mg/kg/d in rats and mice, respectively Estimated NOAEL for systemic toxicity >180 and 360 mg/kg/d in rats and mice respectively. No further information 		

Source	Year set	Standard
<ul style="list-style-type: none"> 13 wk oral study with Na salt in rats exposed at 0, 7, 20 and 60 mg/kg/d (by gavage), 7 d/wk resulted in NOAEL of 20 mg/kg/d and NOEL of 7 mg/kg/d; main effects (reversible) inhibition of β-oxidation of fatty acids Negative results in genotoxicity studies. <p>Skin notation recommended due to systemic effects in animals following low, single doses.</p> <p>DSEN notation warranted but insufficient data available to recommend a TLV-STEL, carcinogenicity or RSEN notations.</p>		
DFG	2012	Not assigned
<p>Review is based on the acid and its NH_4 salt.</p> <p>Summary of additional data:</p> <ul style="list-style-type: none"> Critical effect of the acid is local irritation while main effect of salts are systemic Acid has low potential for contact sensitisation in humans: <ul style="list-style-type: none"> salt has contact sensitisation potential Repeated inhalation exposure studies not available Inhalation and oral carcinogenicity studies in animals not available: <ul style="list-style-type: none"> negative results in dermal carcinogenicity study in mice Average air concentration of NH_4 salt in 21 hairdressing salons 2.6–4.8 $\mu\text{g}/\text{m}^3$; no further information Regarded as corrosive to human skin (from human skin model) Sensitisation most common in hairdressers with suspected occupational allergic dermatitis 4 h LC_{50} of 1,098 mg/m^3 (female rat) and 2,172 mg/m^3 (male rat); nose only; according to OECD TG 13 wk oral study in rats with Na salt (cited in ACGIH, 2018): <ul style="list-style-type: none"> according to OECD report, NOAEL of 20 mg/kg/d is identified as no histopathological changes found after this dose; only reversible biochemical changes in females occurred commission regard NOAEL of 7 mg/kg/d (corresponding to thioglycolate doses of 5.7 mg/kg/d), as observed effects (inhibition of β-oxidation of fatty acids) and correspond with mode of action of the substance Undiluted acid form considered corrosive to rabbit eye; 10% aqueous solution considered irritating. <p>Recommended MAK of 2 mg/m^3 for thioglycolates using NOAEL of 7 mg/kg/d (corresponding to thioglycolate doses of 5.7 mg/kg/d). Value is converted from 7 d/wk to 5 d/wk, a species-specific correction factor of 4 for rats and extrapolation from animal study to derive MAK of 2 mg/m^3.</p>		
SCOEL	NA	NA
No report.		
OARS/AIHA	NA	NA
No report.		

Source	Year set	Standard
HCOTN	NA	NA
No report.		

Secondary source reports relied upon

Source	Year	Additional information
NICNAS	✓ 2013	<ul style="list-style-type: none"> Sublethal signs of toxicity include lethargy, piloerection, drooping eyelid and prostration NOAEL 20 mg/kg/d identified from 90 d oral gavage study (cited in ACGIH, 2018; DFG, 2012): <ul style="list-style-type: none"> changes in blood biochemistry and microscopic histopathological changes in liver consistent with toxic mode of action with increase concentrations of triglycerides in liver due to inhibition of β-oxidation of fatty acids Dermal effects based on data for Na salt; 13 wk dermal study in rats and mice (cited in ACGIH, 2018) identified NOAELs for systemic toxicity >180 mg/kg/d and >360 mg/kg/d, respectively (highest dose tested in each case) No inhalation data available Not considered genotoxic and Na salt not carcinogenic in 7 wk study in mice.
ECHA	✓ 2011	<ul style="list-style-type: none"> No reliable repeated dose toxicity data on the acid, Na salt evaluated NOAEL considered 20 mg/kg/d based on limited blood chemistry effects without microscopic changes in liver.
OECD	✓ 2009	<ul style="list-style-type: none"> No data on absorption of acid or salts by inhalation or oral exposures in humans NH₄ salt should be considered skin sensitiser No reliable data available on repeated dose toxicity of acid or NH₄ salt; repeated dose toxicity of the Na salt evaluated by oral and dermal routes NOAEL 20 mg/kg/d from 13 wk oral study in rats (cited in ACGIH, 2018; DFG, 2012; NICNAS, 2013) LOEL for skin irritation 11.25 and 45 mg/kg/d and the NOAELs for systemic toxicity >180 and 360 mg/kg/d in rats and mice, respectively (dermal study cited in ACGIH, 2018; NICNAS, 2013) Based on weight of evidence, the acid and its salts not considered genotoxic.

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
HCIS	Skin sensitisation – category 1
NICNAS	Skin sensitisation
EU Annex	NA
ECHA	—
ACGIH	DSEN, Skin
DFG	Sh (dermal sensitiser), H (skin)
SCOEL	NA
HCOTN	NA
IARC	NA
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	
Adverse effects in human case study:	yes
Dermal LD ₅₀ ≤ 1000 mg/kg:	yes
Dermal repeat-dose NOAEL ≤ 200 mg/kg:	
Dermal LD ₅₀ /Inhalation LD ₅₀ < 10:	yes
<i>In vivo</i> 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:	92.11
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 3.76 mg/m ³ ; 1 mg/m ³ = 0.266 ppm
This chemical is used as a pesticide:	<input type="checkbox"/>
This chemical is a biological product:	<input type="checkbox"/>



Molecular weight:	92.11
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 3.76 mg/m ³ ; 1 mg/m ³ = 0.266 ppm
This chemical is used as a pesticide:	<input type="checkbox"/>
This chemical is a by-product of a process:	<input type="checkbox"/>
A biological exposure index has been recommended by these agencies:	<input type="checkbox"/> ACGIH <input type="checkbox"/> DFG <input type="checkbox"/> 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) (2013) Thioglycolic acid and its salts – 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).

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Acetic acid, mercapto-: Human health tier II assessment – IMAP report.

Organisation for Economic Cooperation and Development (OECD) (2009) SIDS initial assessment profile – Thioglycolic acid and its ammonium salt.