# Glyoxal

| CAS number: | 107-22-2 |
| --- | --- |
| Synonyms: | Biformal, biformyl, diformyl, ethanedial, ethanedione, 1,2-ethanedione, glyoxalaldehyde, oxalaldehyde |
| Chemical formula: | C2H2O2 |
| Structural formula: | — |

Workplace exposure standard (new)

| TWA: | **0.042 ppm (0.1 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 0.042 ppm (0.1 mg/m3) is recommended to protect for local effects on the respiratory system, and irritation in exposed workers.

## Discussion and conclusions

Glyoxal is used in textiles (permanent press finishes), glues, biocides, embalming fluids, leather tanning and paper coatings. It occurs naturally in brewed coffee and some edible oils.

Critical effects of exposure include local effects in the respiratory system and irritation of the eyes, skin and mucous membranes.

Limited toxicological data exist. A NOAEC of 0.4 mg/m3 is identified in a 29-day study in rats with squamous cell metaplasia in the larynx observed at 2 mg/m3. It is genotoxic only at the site of application. There is insufficient evidence of carcinogenicity in humans and animals (ACGIH, 2018; DFG, 2014). Both the ACGIH (2018) and OARS (2000) recommend a TWA of 0.1 mg/m3.

A TWA of 0.042 ppm (0.1 mg/m3) derived by ACGIH (2018) is recommended. This TWA is expected to be protective of local effects including irritation 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 and not a respiratory sensitiser according to the GHS.

A skin notation is recommended based on evidence of systemic effects in humans and animals following dermal exposure.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA NA NA | |
|  |
| ACGIH 2014 TLV-TWA: 0.042 ppm (0.1 mg/m3) |
| TLV-TWA is recommended to minimise the potential for squamous cell metaplasia in the larynx and to protect against eye, skin and mucous membrane irritation.  Summary of data:  Human data:   * 3 women using hospital disinfectants containing glyoxal developed contact dermatitis and eczema; the eczema stopped when use was discontinued * Case report: 7/9 workers with dermatitis on arms, hands, legs, face or neck patch testing showed sensitisation using 40% solution * No occupational exposure related studies; expected to be irritating to eyes, skin and mucous membrane based on animal studies and human experience with related monoaldehydes (formaldehyde) and dialdehydes (glutaraldehyde).   Animal data:   * Dermal LD50: 6.6 g/kg in guinea pigs using 30% aqueous solution * NOEL of 0.4 mg/m3 in rats (6 h/d, 5 d/wk, 29 d) * squamous cell metaplasia in the larynx observed at 2 mg/m3 * Oral dosing promoted stomach carcinoma in rats; did not produce carcinoma alone indicating it is a weak carcinogenic promoter.   Genotoxicity:   * Genotoxic in tests of point mutations, chromosomal aberration and DNA damage * Mutagenic in: * *S. typhimurium* strains * chinese hamster ovary reversion assay * mouse lymphoma thymidine kinase locus assay * Increased unscheduled DNA synthesis in TC-SV40/INO hamster cells * Damaged DNA in mouse lymphoma L5178Y/TK ± cells.   Insufficient data to recommend a skin or respiratory sensitiser notation. |
| DFG 2014 Not assigned |
| Summary of additional data:   * No adequate empirical data on long-term exposure in humans are available * No chronic inhalation studies in animals; chronic oral studies not considered sufficient; not possible to derive a MAK * Genotoxic only at the site of application; no skin carcinomas at site of application in rats * Assumed that glyoxal is absorbed by the lungs after inhalation and reacts with the DNA within the cells * Histopathological changes in liver, kidneys and pancreas after 40 d following single dermal administration of a 40% glyoxal solution to skin of rabbits. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA 2000 TWA: 0.1 mg/m3 |
| No additional information. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2014 | * LD50: 800 mg/kg (equivalent) (rabbits, dermal) * Caused irritation and necrotic changes in the rabbit eye * LOAEL 107 mg/kg/d in rats; decreased serum protein level * NOAEL of 115 mg/kg/d in dogs. |
| ECHA |  | 2019 | * No further information. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | No |
| **The chemical is not a non-threshold based genotoxic carcinogen.** | |

## Notations

| Source | Notations |
| --- | --- |
| SWA | NA |
| HCIS | Skin sensitisation – category 1 |
| NICNAS | — |
| EU Annex | NA |
| ECHA | Skin Sens. 1 |
| ACGIH | Carcinogenicity – A4, DSEN |
| DFG | Carcinogenicity – 3B, H (skin), Sh (dermal sensitiser) |
| 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 | 4.00 |  | | Dermal LD50 ≤1000 mg/kg: | yes | 3.00 |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  | 3 | **a skin notation is warranted** | |

### IDLH

| Is there a suitable IDLH value available? | No |
| --- | --- |

## Additional information

| Molecular weight: | 58.04 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 2.37 mg/m3; 1 mg/m3 = 0.42 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2004) Glyoxal – MAK value documentation.

European Chemicals Agency (ECHA) (2019) Glyoxal – REACH assessment.

Occupational Alliance for Risk Science (OARS) (2000) Workplace environmental exposure level – Glyoxal.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Ethanedial: Human health tier II assessment – IMAP report.