1 Identification

- **Product identifier**
  - Trade name: Disulfiram
  - Article number: 15303
  - CAS Number: 97-77-8
  - EC number: 202-607-8
  - Index number: 006-079-00-8

- **Application of the substance / the mixture**
  This product is for research use - Not for human or veterinary diagnostic or therapeutic use.

- **Details of the supplier of the safety data sheet**
  - Manufacturer/Supplier: Cayman Chemical Co.
    1180 E. Ellsworth Rd.
    Ann Arbor, MI 48108
    USA
  - Information department: Product safety department
  - Emergency telephone number:
    During normal opening times: +1 (734) 971-3335
    US/CANADA: 800-424-9300
    Outside US/CANADA: 703-741-5970

2 Hazard(s) identification

- **Classification of the substance or mixture**
  - GHS08 Health hazard
    Specific Target Organ Toxicity - Repeated Exposure H373 May cause damage to organs through prolonged or repeated exposure.
  - GHS09 Environment
    Aquatic Acute 1 H400 Very toxic to aquatic life.
    Aquatic Chronic 1 H410 Very toxic to aquatic life with long lasting effects.

(Contd. on page 2)
Trade name: Disulfiram

GHS07
Acute Toxicity - Oral 4 H302 Harmful if swallowed.
Acute Toxicity - Inhalation 4 H332 Harmful if inhaled.
Sensitization - Skin 1 H317 May cause an allergic skin reaction.

· Label elements
· GHS label elements
  The substance is classified and labeled according to the Globally Harmonized System (GHS).
· Hazard pictograms
  GHS07 GHS08 GHS09

· Signal word Warning
· Hazard statements
  H302+H332 Harmful if swallowed or if inhaled.
  H317 May cause an allergic skin reaction.
  H373 May cause damage to organs through prolonged or repeated exposure.
  H410 Very toxic to aquatic life with long lasting effects.
· Precautionary statements
  P260 Do not breathe dust/fume/gas/mist/vapors/spray.
  P264 Wash thoroughly after handling.
  P270 Do not eat, drink or smoke when using this product.
  P271 Use only outdoors or in a well-ventilated area.
  P272 Contaminated work clothing must not be allowed out of the workplace.
  P273 Avoid release to the environment.
  P280 Wear protective gloves.
  P301+P312 If swallowed: Call a poison center/doctor if you feel unwell.
  P302+P352 If on skin: Wash with plenty of water.
  P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
  P314 Get medical advice/attention if you feel unwell.
  P333+P313 If skin irritation or rash occurs: Get medical advice/attention.
  P321 Specific treatment (see on this label).
  P363 Wash contaminated clothing before reuse.
  P391 Collect spillage.
  P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

· Classification system:
· NFPA ratings (scale 0 - 4)
  Health = 3
  Fire = 0
  Reactivity = 0

· HMIS-ratings (scale 0 - 4)
  Health = 2
  Fire = 0
  Reactivity = 0
3 Composition/information on ingredients

- Chemical characterization: Substances
  - CAS No. Description
    97-77-8 Disulfiram
  - Identification number(s)
    - EC number: 202-607-8
    - Index number: 006-079-00-8

4 First-aid measures

- Description of first aid measures
  - General information:
    Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
  - After inhalation:
    Supply fresh air and to be sure call for a doctor.
    In case of unconsciousness place patient stably in side position for transportation.
  - After skin contact:
    Immediately wash with water and soap and rinse thoroughly.
  - After eye contact:
    Rinse opened eye for several minutes under running water.
  - After swallowing:
    Immediately call a doctor.
  - Information for doctor:
    - Most important symptoms and effects, both acute and delayed
      No further relevant information available.
    - Indication of any immediate medical attention and special treatment needed
      No further relevant information available.

5 Fire-fighting measures

- Extinguishing media
  - Suitable extinguishing agents:
    Use fire fighting measures that suit the environment.
    A solid water stream may be inefficient.
  - Special hazards arising from the substance or mixture
    No further relevant information available.
  - Advice for firefighters
    - Protective equipment: Mouth respiratory protective device.

6 Accidental release measures

- Personal precautions, protective equipment and emergency procedures
  Not required.
- Environmental precautions:
  Inform respective authorities in case of seepage into water course or sewage system.
  Do not allow to enter sewers/ surface or ground water.
- Methods and material for containment and cleaning up:
  Dispose contaminated material as waste according to section 13.
7 Handling and storage

- Handling:
  - Precautions for safe handling
    Thorough dedusting.
    Ensure good ventilation/exhaustion at the workplace.
  - Information about protection against explosions and fires: No special measures required.

- Conditions for safe storage, including any incompatibilities
  - Storage: Store in accordance with information listed on the product insert.
  - Requirements to be met by storerooms and receptacles: No special requirements.
  - Information about storage in one common storage facility: Not required.
  - Further information about storage conditions: Keep receptacle tightly sealed.

- Specific end use(s) No further relevant information available.

8 Exposure controls/personal protection

- Additional information about design of technical systems: No further data; see section 7.

- Control parameters

- Components with limit values that require monitoring at the workplace:

<table>
<thead>
<tr>
<th>Component</th>
<th>REL Long-term value: 2 mg/m³</th>
<th>Avoid concurrent exposure to Ethylene dibromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>97-77-8 Disulfiram</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TLV Long-term value: 2 mg/m³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td></td>
</tr>
</tbody>
</table>

- Additional information: The lists that were valid during the creation were used as basis.

- Exposure controls

- Personal protective equipment:
  - General protective and hygienic measures:
    Keep away from foodstuffs, beverages and feed.
    Immediately remove all soiled and contaminated clothing.
    Wash hands before breaks and at the end of work.
    Store protective clothing separately.
  - Breathing equipment:
    In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
56.0.21

· Protection of hands:

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· Eye protection:

Safety glasses

Tightly sealed goggles

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9 Physical and chemical properties

· Information on basic physical and chemical properties

· General Information

· Appearance:

  · Form: Solid
  · Color: Not determined.
  · Odor: Characteristic

· Structural Formula

  C10H20N2S4

· Molecular Weight

  296.5 g/mol

· Odor threshold:

  Not determined.

· pH-value:

  Not applicable.

· Change in condition

  · Melting point/Melting range: 71–72 °C (159.8–161.6 °F)
  · Boiling point/Boiling range: 1.17 °C (34.1 °F)

· Flash point:

  Not applicable.

· Flammability (solid, gaseous):

  Product is not flammable.

· Decomposition temperature:

  Not determined.

· Ignition temperature:

  Not determined.

· Danger of explosion:

  Product does not present an explosion hazard.

· Explosion limits:

  · Lower: Not determined.
  · Upper: Not determined.
Safety Data Sheet
acc. to OSHA HCS

Printing date 04/21/2023  Revision date 04/21/2023

Trade name: Disulfiram

(Contd. from page 5)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Vapor pressure</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>· Density at 20 °C (68 °F):</td>
<td>1.3 g/cm³ (10.8485 lbs/gal)</td>
</tr>
<tr>
<td>· Relative density</td>
<td>Not determined.</td>
</tr>
<tr>
<td>· Vapor density</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>· Evaporation rate</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>· Solubility in / Miscibility with Water</td>
<td>Not determined.</td>
</tr>
<tr>
<td>· Partition coefficient (n-octanol/water)</td>
<td>Not determined.</td>
</tr>
<tr>
<td>· Viscosity</td>
<td></td>
</tr>
<tr>
<td>· Dynamic</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>· Kinematic</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>· SOLUBILITY</td>
<td>DMF: 5 mg/ml; DMF: PBS (pH 7.2) (1:4): 0.2 mg/ml; DMSO: 5 mg/ml; Ethanol: 5 mg/ml</td>
</tr>
<tr>
<td>· Other information</td>
<td>No further relevant information available.</td>
</tr>
</tbody>
</table>

10 Stability and reactivity

· Reactivity No further relevant information available.
· Chemical stability
· Thermal decomposition / conditions to be avoided: No decomposition if used according to specifications.
· Possibility of hazardous reactions No dangerous reactions known.
· Conditions to avoid No further relevant information available.
· Incompatible materials: strong oxidizing agents
· Hazardous decomposition products: carbon dioxide, carbon monoxide, carbon monoxide,carbon monoxide

11 Toxicological information

· RTECS Number JO1225000
· Information on toxicological effects
· Acute toxicity:
· LD/LC50 values that are relevant for classification:

<table>
<thead>
<tr>
<th>Route</th>
<th>LD/LC50 values</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral LDLO</td>
<td>90 mg/kg/18D intermittent (wmn)</td>
<td></td>
</tr>
<tr>
<td>LD50</td>
<td>500 mg/kg (rat)</td>
<td></td>
</tr>
<tr>
<td>Intraperitoneal LD50</td>
<td>75 mg/kg (mouse)</td>
<td></td>
</tr>
<tr>
<td>Subcutaneous LD50</td>
<td>2,600 mg/kg (mouse)</td>
<td></td>
</tr>
<tr>
<td>Subcutaneous LD</td>
<td>&gt;4 g/kg (rat)</td>
<td></td>
</tr>
</tbody>
</table>

· Primary irritant effect:
· on the skin: No irritant effect.
· on the eye: No irritating effect.
· Sensitization: Sensitization possible through skin contact.
· Additional toxicological information:
· Carcinogenic categories
· IARC (International Agency for Research on Cancer) 3
· NTP (National Toxicology Program) Substance is not listed.
12 Ecological information

- Toxicity
  - Aquatic toxicity: No further relevant information available.
  - Persistence and degradability: No further relevant information available.
- Behavior in environmental systems:
  - Bioaccumulative potential: No further relevant information available.
  - Mobility in soil: No further relevant information available.
- Ecotoxicological effects:
  - Remark: Very toxic for fish
- Additional ecological information:
  - General notes:
    Water hazard class 3 (Assessment by list): extremely hazardous for water
    Do not allow product to reach ground water, water course or sewage system, even in small quantities.
    Danger to drinking water if even extremely small quantities leak into the ground.
    Also poisonous for fish and plankton in water bodies.
    Very toxic for aquatic organisms
  - Results of PBT and vPvB assessment
    - PBT: Not applicable.
    - vPvB: Not applicable.
  - Other adverse effects: No further relevant information available.

13 Disposal considerations

- Waste treatment methods
  - Recommendation: Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
- Uncleaned packagings:
  - Recommendation: Disposal must be made according to official regulations.

14 Transport information

- UN-Number
  - DOT, IMDG, IATA: UN3077
- UN proper shipping name
  - DOT, IATA: Environmentally hazardous substance, solid, n.o.s. (Disulfiram)
  - IMDG: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Disulfiram)
Trade name: Disulfiram

### Transport hazard class(es)
- DOT

#### IMDG, IATA

- Class: 9 Miscellaneous dangerous substances and articles
- Label: 9

#### Packing group
- DOT, IMDG, IATA
- Class: III

### Environmental hazards:
- Marine pollutant:
- Special marking (IATA):
  - Symbol (fish and tree)

### Special precautions for user
- Warning: Miscellaneous dangerous substances and articles
- Hazard identification number (Kemler code): 90
- EMS Number: F-A,S-F
- Stowage Category: A
- Stowage Code: SW23 When transported in BK3 bulk container, see 7.6.2.12 and 7.7.3.9.

### Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
- Not applicable.

### Transport/Additional information:
- DOT
  - Quantity limitations:
    - On passenger aircraft/rail: 400 kg
    - On cargo aircraft only: 400 kg

- IMDG
  - Limited quantities (LQ): 5 kg
  - Exected quantities (EQ):
    - Code: E1
    - Maximum net quantity per inner packaging: 30 g
    - Maximum net quantity per outer packaging: 1000 g

- IATA
  - Remarks:
    - When sold in quantities of less than or equal to 1 mL, or 1 g, with an Exected Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10.
    - Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.
Safety Data Sheet  
acc. to OSHA HCS

Trade name: Disulfiram

(Contd. from page 8)

· UN "Model Regulation":  
  UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (DISULFIRAM), 9, III

15 Regulatory information

· Safety, health and environmental regulations/legislation specific for the substance or mixture  
  No further relevant information available.
· Sara
· Section 355 (extremely hazardous substances): Substance is not listed.
· Section 313 (Specific toxic chemical listings): Substance is not listed.
· TSCA (Toxic Substances Control Act): ACTIVE
· Hazardous Air Pollutants Substance is not listed.
· Proposition 65
· Chemicals known to cause cancer: Substance is not listed.
· Chemicals known to cause reproductive toxicity for females: Substance is not listed.
· Chemicals known to cause reproductive toxicity for males: Substance is not listed.
· Chemicals known to cause developmental toxicity: Substance is not listed.
· Carcinogenic categories
· EPA (Environmental Protection Agency) Substance is not listed.
· TLV (Threshold Limit Value) A4
· NIOSH-Ca (National Institute for Occupational Safety and Health) Substance is not listed.
· Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other information

All chemicals may pose unknown hazards and should be used with caution. This SDS applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this SDS. Cayman Chemical Company assumes no responsibility for incidental or consequential damages, including lost profits, arising from the use of these data. It shall be the user’s responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this SDS is based on technical data judged to be reliable, Cayman Chemical Company assumes no responsibility for the completeness or accuracy of the information contained herein.

· Department issuing SDS: Environment protection department.
· Contact: -
· Date of preparation / last revision 04/21/2023
· Abbreviations and acronyms:
  - IMDG: International Maritime Code for Dangerous Goods
  - DOT: US Department of Transportation
  - IATA: International Air Transport Association
  - EINECS: European Inventory of Existing Commercial Chemical Substances
  - CAS: Chemical Abstracts Service (division of the American Chemical Society)
  - NFPA: National Fire Protection Association (USA)
  - HMIS: Hazardous Materials Identification System (USA)
  - LC50: Lethal concentration, 50 percent
  - LD50: Lethal dose, 50 percent
  - PBT: Persistent, Bioaccumulative and Toxic
  - vPvB: very Persistent and very Bioaccumulative
  - NIOSH: National Institute for Occupational Safety
  - OSHA: Occupational Safety & Health
  - TLV: Threshold Limit Value
  - PEL: Permissible Exposure Limit
  - REL: Recommended Exposure Limit
  - Acute Toxicity - Oral 4: Acute toxicity – Category 4

(Contd. on page 10)
Trade name: Disulfiram

Sensitization - Skin 1: Skin sensitisation – Category 1
Specific Target Organ Toxicity - Repeated Exposure 2: Specific target organ toxicity (repeated exposure) – Category 2
Aquatic Acute 1: Hazardous to the aquatic environment - acute aquatic hazard – Category 1
Aquatic Chronic 1: Hazardous to the aquatic environment - long-term aquatic hazard – Category 1

* Data compared to the previous version altered.