
Disulphur dichloride

(CAS No: 10025-67-9)

Health-based Reassessment of Administrative Occupational Exposure Limits

Committee on Updating of Occupational Exposure Limits,
a committee of the Health Council of the Netherlands

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1 Introduction

The present document contains the assessment of the health hazard of disulphur dichloride by the Committee on Updating of Occupational Exposure Limits, a committee of the Health Council of the Netherlands. The first draft of this document was prepared by A Wientjes, M.Sc. and H Stouten, M.Sc. (TNO Nutrition and Food Research, Zeist, the Netherlands).

The evaluation of the toxicity of disulphur dichloride has been based on the review by the American Conference of Governmental Industrial Hygienists (ACGIH) (ACG91). Where relevant, the original publications were reviewed and evaluated as will be indicated in the text. In addition, in January 1998, literature was searched in the on-line databases Medline, Cancerlit, Toxline, and Chemical Abstracts, starting from 1966, 1963, 1965, and 1967, respectively, and using the following key words: sulfur chloride, S₂Cl₂, disulphur dichloride, sulfur monochloride, chlorosulfane, dichlorodisulfane, sulfur subchloride, thiosulfurous dichloride, and 10025-67-9.

In July 2000, the President of the Health Council released a draft of the document for public review. No comments were received.

An additional search in Toxline and Medline in November 2003 did not result in information changing the committee's conclusions.

2 Identity

name	:	disulphur dichloride
synonyms	:	disulfur dichloride; sulphur monochloride; sulfur monochloride; sulphur chloride; sulfur chloride; sulphur subchloride; sulfur subchloride; thiosulphurous dichloride; thiosulfurous dichloride
molecular formula	:	Cl ₂ S ₂
structural formula	:	ClSSCl
CAS number	:	10025-67-9

3 Physical and chemical properties

molecular weight	:	135.03
boiling point	:	136°C
melting point	:	-77°C
flash point	:	130°C (open cup); 118°C (closed cup)
vapour pressure	:	at 20°C: 0.9 kPa
solubility in water	:	decomposes
log P _{octanol/water}	:	4.26 (estimated)
conversion factors	:	at 20°C, 101.3 kPa: 1 ppm = 5.63 mg/m ³ 1 mg/m ³ = 0.18 ppm

Data from ACG91, NLM03, <http://esc.syrres.com>.

Disulphur dichloride is an amber, oily, non-flammable, fuming liquid that has a penetrating odour. The substance reacts violently with water, yielding sulphur, hydrogen chloride, sulphur dioxide, hydrogen sulphide, sulphite, and thiosulphate. In contact with air, corrosive gases such as hydrogen chloride can be formed (ACG91).

4 Uses

Disulphur dichloride is used in vulcanising rubber, manufacture of organic chemicals, printers' inks, varnishes, and cements, in hardening soft woods, and as an agricultural insecticide. Disulphur dichloride is also used for production of white vulcanised oils used for coating and impregnating textiles, modifying agents in erasers, purifying sugar juices, and gold extraction (ACG91, NLM03).

According to the database of the Dutch Pesticide Authorisation Board (CTB)*, disulphur dichloride is at present not permitted in the Netherlands for use as an active ingredient in pesticides.

5 Biotransformation and kinetics

The committee did not find data on the biotransformation and kinetics of disulphur dichloride.

* At: <http://www.ctb-wageningen.nl>

6 Effects and mechanism of action

Human data

Disulphur dichloride is considered an ocular, mucous membrane, and dermal irritant with a nauseating odour. Splashes of the liquid in the eyes will produce prompt, severe damage. Percutaneous contact with liquid disulphur dichloride will produce chemical burns and skin irritation if not removed immediately (ACG91). A concentration of approximately 12 mg/m³ (2 ppm) was described as nauseating (Rut86).

Concentrations of 2-9 ppm (ca. 11-50 mg/m³) disulphur dichloride, found in the rubber industry, were stated to be only mildly irritating. These conclusions, however, were based on analytical determination by disulphur dichloride absorption in alkali and determination of the chloride and, as such, may have included a high proportion of hydrogen chloride (ACG91).

A case of severe burns of the eyes and other body parts from contact with disulphur dichloride has been reported (Pey87).

Animal data

No rats (n=5/sex/group) died from exposure to 1723 mg/m³ (310 ppm) or below. At 2500, 2870, and 3487 mg/m³ (ca. 450, 520, 630 ppm), mortality was 30, 60, and 100%, respectively, indicating an approximate 4-hour LC₅₀ of 2500 mg/m³ (450 ppm). Clinical signs observed at 1335 mg/m³ (240 ppm) and above included ungroomed fur, piloerection, reduced motility, laboured and decelerated breathing, dyspnoea, and bloody and nasal discharge. At 2500 mg/m³ and above, extreme bradypnoea, cyanosis, corneal opacity, and necrotic changes at nose/muzzle area were seen as well. At necropsy of the animals that died within the 14-day observation period, there were emphysema and oedema of the liver-like-changed lungs, hydrothorax, pale spleen and liver, gastrointestinal tract with bloody yellowish mucous content, reddening of the glandular stomach, and reddening and necrotic changes at the rhinarium. Some of the rats sacrificed at the end of the observation period showed emphysema and oedema of the lungs with liver-like or dark-red areas as well (Bom00). In mice, the LC₅₀ was 150 ppm (850 mg/m³) (exposure duration not indicated) (NIO03). Referring to information published in 1931, it was stated that a concentration of 150 ppm (840 mg/m³) has been fatal to mice after an exposure of 1 minute; exposure to 12 ppm (67 mg/m³) for 15 minutes was tolerated by cats, but an exposure to about

50 ppm (240 mg/m³) for 15 minutes could induce delayed deaths after a few days (ACG91).

In rats (n=5/sex/group) given single oral doses of 50, 60, 70, 80, 200, and 500 µL/kg bw (ca. 84, 101, 118, 135, 169, and 840 mg/kg bw), mortality was 0, 20, 40, 60, 70, and 100%, respectively, from which an LD₅₀ of 132 mg/kg bw was calculated. Animals died on days 1 to 8. The onset of symptoms was 15 minutes to 8 hours post-administration. At doses of 101 mg/kg bw and above, they included poor general condition, piloerection, lateral and ventral position, narcosis, and growth retardation. At necropsy of dead animals and of animals sacrificed at the end of the 14-day observation period, loss of gastric mucosal relief, reddened stomach and intestines, and dark-brownish discoloured liver and spleen were observed (Bom00).

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for disulphur dichloride in the Netherlands is 6 mg/m³ (1 ppm), which is a ceiling value.

Existing occupational exposure limits for disulphur dichloride in some European countries and in the USA are summarised in the annex.

8 Assessment of health hazard

Disulphur dichloride is considered to be irritating to the eyes, mucous membranes, and skin.

In experimental animals, LC₅₀ values of ca. 2500 (450 ppm) (exposure duration: 4 hours) and 840 mg/m³ (150 ppm) (duration not reported) were estimated in rats and mice, respectively. The oral LD₅₀ was 132 mg/kg bw in rats.

The committee did not find other data from other studies on the effects of disulphur dichloride, such as irritation, sensitisation, repeated-dose toxicity - including carcinogenicity and reproduction toxicity – and mutagenicity and genotoxicity.

The committee considers the toxicological database on disulphur dichloride too poor to justify recommendation of a health-based occupational exposure limit.

The committee concludes that there is insufficient information to comment on the level of the present MAC-value.

References

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- ACG03 American Conference of Governmental Industrial Hygienists (ACGIH). Guide to occupational exposure values - 2003. Cincinnati OH, USA: ACGIH®, 2003: 123.
- ACG04 American Conference of Governmental Industrial Hygienists (ACGIH). 2004 TLVs® and BEIs® based on the documentation of the Threshold Limit Values for chemical substances and physical agents & Biological Exposure Indices. Cincinnati OH, USA: ACGIH®, 2004: 52.
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- Swe00 Swedish National Board of Occupational Safety and Health. Occupational exposure limit values and measures against air contaminants. Solna, Sweden: National Board of Occupational Safety and Health, 2000; Ordinance AFS 2000:3.
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TRG03 TRGS 900. Grenzwerte in der Luft am Arbeitsplatz; Technische Regeln für Gefahrstoffe. BArBl 2003; (9).

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Annex

Occupational exposure limits for disulphur dichloride in various countries.

country - organisation	occupational exposure limit		time-weighted average	type of exposure limit	note ^a	reference ^b
	ppm	mg/m ³				
the Netherlands - Ministry of Social Affairs and Employment	1	6	ceiling	administrative		SZW04
Germany - AGS	1	5,6	8 h			TRG03
- DFG MAK-Kommission	1	5,6	15 min			DFG03
Great-Britain - HSE	1	5.6	15 min			HSE02
Sweden	-	-				Swe00
Denmark	1	6	ceiling			Arb02
USA - ACGIH	1	-	ceiling	TLV		ACG04
- OSHA	1	6	8 h	PEL		ACG03
- NIOSH	1	6	ceiling	REL		ACG03
European Union - SCOEL	-	-				EC04

^a S = skin notation; which means that skin absorption may contribute considerably to body burden; sens = substance can cause sensitisation.

^b Reference to the most recent official publication of occupational exposure limits.

^c Listed among compounds for which studies of the effects in man or experimental animals have yielded insufficient information for the establishment of MAK values.

