IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Sodium diethyldithiocarbamate


Identification | Characterisation | Formula | Physical and chemical properties | Toxicology / Ecotoxicology | Occupational health and first aid | Regulations | Links | Literature register

IDENTIFICATION

Sodium diethyldithiocarbamate

ZVG No:	15110	
CAS No:	148-18-5	anhydrous
EC No:	205-710-6	
Related		
CAS No:	20624-25-3	trihydrate

CHARACTERISATION

SUBSTANCE GROUP CODE

122200 Sodium compounds
147900 Thiocarbamide acid, dithiocarbamide acid and their derivatives

STATE OF AGGREGATION

The substance is solid.

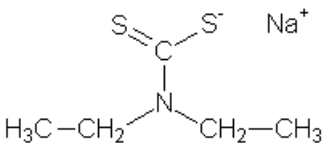
PROPERTIES

crystalline
white

Substance information in Wikipedia

FORMULA

$C_5H_{10}NNaS_2$



Molar mass: 171,27 g/mol

PHYSICAL AND CHEMICAL PROPERTIES

Melting point | Density |
Solubility

MELTING POINT

Melting point: 95 °C

Reference: 00454 02090

DENSITY

DENSITY

Value: 1,1 g/cm³

Temperature: 20 °C

Reference: 00454 02090

SOLUBILITY IN WATER

Concentration: 278 g/l

The substance is manufactured and placed on the market as ca. 26% (w/w) solution in water, which is the maximum possible concentration.

Temperature: 20 °C

Reference: 07520

TOXICOLOGY / ECOTOXICOLOGY

TOXICOLOGICAL DATA

LD50 oral rat

Value: 1500 mg/kg

Drugs of the Future. Vol. 6, Pg. 225, 1981.

LD50 dermal

Species: Rat

Value: › 1000 mg/kg

World Review of Pest Control. Vol. 9, Pg. 119, 1970.

Reference: 02071

ECOTOXICOLOGICAL DATA

LC50 Fish (96 hours)

Minimum: 6,9 mg/l

Maximum: 6,9 mg/l

Median: 6,9 mg/l

Study number: 1

Reference for median:

Van Leeuwen, C.J., J.L. Maas-Diepeveen, G. Niebeek, W.H.A. Vergouw, P.S. Griffioen, and M.W. Luijken 1985. Aquatic Toxicological Aspects of Dithiocarbamates and Related Compounds. I. Short-Term Toxicity Tests. Aquat.Toxicol. 7(3):145-164

LC50 Crustaceans (48 hours)

Minimum:	0,91 mg/l
Maximum:	0,91 mg/l
Median:	0,91 mg/l
Study number:	1

Reference for median:

Van Leeuwen, C.J., J.L. Maas-Diepeveen, G. Niebeek, W.H.A. Vergouw, P.S. Griffioen, and M.W. Luijken 1985. Aquatic Toxicological Aspects of Dithiocarbamates and Related Compounds. I. Short-Term Toxicity Tests. Aquat.Toxicol. 7(3):145-164

EC50 Algae (72 or 96 hours)

Test duration:	96 hours
Minimum:	1,4 mg/l
Maximum:	1,4 mg/l
Median:	1,4 mg/l
Study number:	1

Reference for median:

Van Leeuwen, C.J., J.L. Maas-Diepeveen, G. Niebeek, W.H.A. Vergouw, P.S. Griffioen, and M.W. Luijken 1985. Aquatic Toxicological Aspects of Dithiocarbamates and Related Compounds. I. Short-Term Toxicity Tests. Aquat.Toxicol. 7(3):145-164

Reference: 02072

OCCUPATIONAL HEALTH AND FIRST AID

Routes of exposure | Toxic effects |
First Aid

ROUTES OF EXPOSURE

Main routes of exposure

Under occupational conditions, the main intake pathway for sodium diethyldithiocarbamate (S.) probably proceeds via the respiratory tract.[99999]

Respiratory tract

Exposure is conceivable during the manufacture and further processing in the form of dusts or aerosols from aqueous solutions.[99999]
No data is available on absorbability.[99983]
However, based on the physico-chemical properties of the solutions, effective intake should be expected directly in the respiratory tract and/or via the gastrointestinal tract if the noxa has been transported there by means of mucociliary clearance.[99999]

Skin

No kinetic data on dermal intake is available.[99983]
From the only available dermal animal experiment, there was no indication of absorbability.[00438]
S. solutions split off carbon disulfide under neutral or acidic conditions. This is very well absorbable through the skin. Therefore, a certain penetrability of S. (or its concentrated solutions) should be expected following massive or prolonged contact with moist skin.[99999]

Gastrointestinal tract

Very rapid and nearly complete absorption is derivable from kinetic studies on volunteers and animal experiments on various species.[07619]

TOXIC EFFECTS

Main toxic effects

Acute:
Irritation to the eyes and skin through dusts and solutions, dependent on their concentration (probably from 10 % upwards);
sensitizing potential;[07742]
gastrointestinal complaints, disturbances to the CNS
Chronic:
Gastrointestinal complaints, intolerability to alcohol;
effects on the nervous system[07619]

Acute toxicity

S. or the N,N-diethyldithiocarbamate ion are the primary biotransformation products of disulfiram (tetraethylthiuram disulfide). Therefore these substances are closely related to one another with regard to their systemic toxic potential. Because of its alkalinity in aqueous solution, the local activity of S. is assigned a higher grading in comparison to disulfiram which is nearly insoluble in water.[07619]
3 drops of 5 % S. solution in gum arabic did not cause irritation to rabbits' eyes.[07742]
This result is insufficient to disregard the eye irritating action expected for dusts and concentrated solutions.[99999]
10 % aqueous solution was found to be the threshold concentration for irritation to the skin of guinea pigs following occlusive 24 h contact.[07742]
The distinct skin sensitizing potential determined for disulfiram was not clearly detectable for S. either from animal experiments or on humans. However, because of the cross reactivity with structurally similar thiuram compounds, a sensitizing action to the human skin is assumed.[07619]
Regarding the dermal toxicity only one experiment on rats has been referred. An LD50 value of › 1 g/kg bw resulted (no further data given).[00438]
No data is available on the inhalative intake of dusts/aerosols.[99983]
No irritation to the airways is expected to result at low concentrations (below about 5 mg/m3) whereas a distinct irritating potential is assumed for 20 mg/m3.
On volunteers, oral doses of up to 500 mg (7.1 mg/kg bw) did not cause either direct clinical symptoms or intolerability to alcohol. In comparison, infusion of the lyophilized substance in doses of 60, 80 or 100 mg/kg bw for 4 hours produced nausea, vomiting, sleepiness, chest pain, sneezing, burning sensation to the mucous membranes, reddening to the face and skin and headache. The infusion of both of the high dosages had to be stopped prematurely. The symptoms persisted for up to 4 days. Under analogous conditions, doses of 20 and 40 mg/kg bw only caused slight vertigo and a dazed feeling.
LD50 values for rodents were found between 1500 and 3350 mg/kg bw. The following symptoms were found: strong excitation, clonic spasms and (in one study on rats within 24 hours p.appl.) severe damage to the liver.[07619]

Chronic toxicity

Data on the consequences of repeated dermal or inhalative exposure to S. are not available either for humans or from animal experiments.[99983]
However, because of the applicability as a therapeutic agent, various clinical studies on humans and numerous animal experiments with oral and intravenous application have been carried out: Patients who orally received up to 20 mg/kg bw once per week or even up to 30 mg S./kg bw daily for 14 days did not suffer from significant side effects, aside from temporary complaints (metal taste, nausea, stomach pain and sometimes intolerability to alcohol). Similar effects were also produced through intravenous infusion of 5 mg/kg bw (once per week) or 20 - 30 mg/kg bw daily for up to 14 days. Still higher doses (up to 80 mg/kg bw) caused reversible disturbances to the CNS during the period of application (twice per week).
For the estimation of tolerable concentrations for inhalative exposure, intravenous experiments seem to be more suitable then oral experiments (based on the instability of S. in the acidic stomach contents).
In a GLP study, rats received 30 mg/kg bw intravenously twice per week for 26 weeks. Aside from slight inflammation on the application area they did not show any symptoms. 100 mg caused prostration and seizures whereas a further 300 mg produced changes to the liver and atrophy of the testes for 3 of 14 animals. From these data, about 12 mg/kg bw was calculated as a NOAEL for a daily intravenous application. Findings in the kidneys seen following oral application to rats did not appear here.
For other animal species or pathways of application there were other or additional findings which in part were attributed to CNS disturbances. However, in part they also affected the function of the thyroid gland. Because of this pronounced variability, the numerous individual findings available were assigned a lower importance in the estimation of the risk assessment than the "toxicological relationship" between S. and disulfiram. The resulting tolerable inhalation concentration corresponds to a maximum intake per working day of 0.3 mg/kg bw. This value is considerably lower than intravenous doses for humans and animals which experience has shown to be effective.
[07619]

Reproductive toxicity, mutagenicity, carcinogenicity

For classifying the reproductive toxicity and mutagenic and carcinogenic potential see list in Annex VI of the CLP regulation / TRGS 905 / List of MAK values (see section REGULATIONS).
Reproductive toxicity:
The available information was considered to be insufficient for evaluation and hence for classification.
In studies on rats and mice, no developmental toxic effects were found at the relevant concentration level. It remains to be clarified whether the unusually low NOAEL for rabbits (2.5 mg/kg bw, intravenously) is also relevant for humans.
This is not expected.
Mutagenicity:
In various in-vitro systems, S. proved to be mutagenic. This could be due to its capability of inactivation of enzymic systems protecting against oxidative stress (e.g. superoxide dismutase). In the few in-vivo tests available the substance was ineffective.[07619]
Carcinogenicity:
Final assessment of the carcinogenic risk has not yet been carried out.[99983]
In a 2 year feeding study on rats and mice, no carcinogenic potential was detectable for S.[07619]

Biotransformation and excretion

The half life of absorbed S. in plasma is less than 30 min.
It increases with increasing doses. The substance and its metabolites are rapidly distributed and redistributed into various organ systems. Besides carbon disulfide and its consecutive products, the main metabolite is the lipophilic ester methyl diethyldithiocarbamate. This is eliminated after further metabolism as sulfate, and the S-glucuronide.
Along with sulfate, the latter is the predominating metabolite in the urine. The part of carbon disulfide non-metabolized is exhaled via the lung.[07619]
The various effects of S. and its biotransformation products are attributed to their reactivity to divalent metals (chelation) as well as amino groups and SH-groups of proteins and amino acids. In this way, various enzyme systems (e.g. aldehyde dehydrogenase and dopamine-betahydroxylase) are inactivated. Various consecutive reactions can then result.[99997]

Annotation

This occupational health information was compiled on 02.09.2002.
It will be updated if necessary.

FIRST AID

Eyes

Rinse the affected eye with widely spread lids for 10 minutes under running water whilst protecting the unimpaired eye.
Then, immediately transport the casualty to an eye doctor / to hospital.
[08013, 99999]

Skin

Remove contaminated clothing while protecting yourself.
Cleanse the affected skin areas thoroughly with soap under running water.
Under no circumstances should alcohol, gasoline or other solvents be used.
Following massive contact or if irritation is felt:
Arrange for medical treatment.
[08013, 99999]

Respiratory tract

Whilst protecting yourself remove the casualty from the hazardous area and take him to the fresh air.
Lay the casualty down in a quiet place and protect him against hypothermia.
In the case of breathing difficulties have the casualty inhale oxygen.
Arrange medical treatment.
If there is irritation to the airways or difficulty in breathing:
As soon as possible repeatedly have the casualty deeply breath a glucocorticoid inhalation spray in.

Swallowing

Rinse the mouth and spit the fluids out.
If the casualty is conscious have him drink 1 glass of water (ca 200 ml).
Under no circumstances apply cooking oil, castor oil, milk or alcohol.
Arrange medical treatment.
Poisoning symptoms can appear after a period of delay.
Under no circumstances apply beverages/drugs containing alcohol (e.g. ipecac-syrup which is sometimes used as an emetic)!

Information for physicians

The substance is the primary biotransformation product of disulfiram ("antabus") and is therefore similar with regard to absorptive-toxic effects. The relatively low oral toxicity is significantly strengthened through the intake of alcohol (at least up to 12 h before and several days after the poisoning).
The local action is stronger than that of disulfiram. In addition, it is absorbed considerably more rapidly.[07619]
The following information contains experience and knowledge available for poisoning cases with disulfiram.[99983]

- Symptoms of acute poisoning:
Eyes: probable distinct to strong irritation through dusts or concentrated aqueous solutions[07619]
Skin: irritation virtually only through solutions › 10 %;[07742] sensitizing potential;[07619] absorptive-toxic effects following massive or prolonged contact not to be excluded (no studies available)[99999]
Inhalation: probable irritation to the airways following overexposure to dusts or aerosols from concentrated solutions; then systemic effects also not to be excluded;[07619] lung damage due to massive exposure to dust?[99999]
Ingestion: irritation of mucous membranes contacted through high doses, probably rapid or shortly delayed entry of absorptive-toxic effects
Absorption: gastrointestinal disturbances (nausea, emesis, diarrhoea), hyperemia in the face, headache; following high doses: strong excitation, vertigo, tremor, ataxia, clonic cramps, possibly strong function changes through to severe damage to the liver;[07619] possibly also strong disturbances to the heart/circulatory system (arrhythmia, tachycardia, hypotension up to collapse).[08013]

- Medical advice:
After contact with the eyes, first aid measures to the casualty should be followed by an ophthalmologic check/further treatment in every case, even if irritation has subsided.
Contamination of the skin by the solid matter requires intensive cleansing (in the meantime with PEG 400) but in general probably no further therapy. Allergic skin reactions should be treated symptomatically.
Following massive inhalation of dusts apply fresh air, best apply air with supplementary oxygen or initiate artificial ventilation (intubation as needed). If necessary apply glucocorticoids topically. Arrange quickest possible hospitalization.[99999]
Following oral intake have the casualty drink rather a lot of water and provoke vomiting provided absorptive-toxic effects are still absent.[08013]
As a (better) alternative, a gastrolavage should be carried out as soon as possible (in contrast to poisoning with disulfiram for which more time is available). Subsequently, apply an isotonic solution of sodium sulfate with large amounts of supplementary charcoal.[99999]
Do not use castor oil, milk or magnesium sulfate as a laxative.[08013]
Under no circumstances use ipecacuanha because of its alcohol content (-› acetaldehyde syndrom)!
For continued vomiting, 10 - 20 mg metoclopramide can be applied slowly, intravenously. Alternatively, 1 - 2 mg/kg bw dissolved in 50 ml of physiological saline or 50 ml of 5 % glucose can be infused. Additional application of a histamine-H2-receptor blocking drug (e.g. cimetidine) is possible. Hypovolemic shock due to dehydration or peripheral vasodilation should initially treated with solutions of electrolytes and glucose and in addition with noradrenaline if necessary. For cramps, 10 - 20 mg diazepam can be injected intravenously. Unspecific neurological disturbances can be treated with pyridoxine.
If a therapy is necessary for the acetaldehyde syndrom, 500 mg of ascorbic acid or 20 - 40 mg iron could possibly be injected (analogy to disulfiram?). In every case, hospitalization must be arranged as soon as possible in order to be able to diagnostically examine the poisoning in the best possible way.[99999]

Recommendations

Provide the physician information about the substance/product and treatment already administered.
Absolute abstinence from alcohol is necessary for at least 10 days after the poisoning.[08013]

Annotation

This first aid information was compiled on 02.09.2002.
It will be updated if necessary.

REGULATIONS

GHS Classification/Labelling | Workplace labelling | Air quality control | Transport Regulations | MAK recommendations | SevesoIII | Technical rules

EUROPEAN GHS CLASSIFICATION AND LABELLING

Classification

Acute toxicity, Category 4, oral; H302
Skin irritation, Category 2; H315
Eye irritation, Category 2; H319
Specific Target Organ Toxicity (single exposure), Category 3; H335
Hazardous to the aquatic environment, Acute Category 1; H400


Signal Word "Warning"

Hazard Statement - H-phrases

H302: Harmful if swallowed.
H315: Causes skin irritation.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H400: Very toxic to aquatic life.

Precautionary Statement - P-phrases

P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P270: Do not eat, drink or smoke when using this product.
P273: Avoid release to the environment.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310: Immediately call a POISON CENTER or doctor.

Manufacturer's specification by Thermo Fisher Scientific

Reference: 01231
State: 2021
Checked: 2022

GHS-CLASSIFICATION OF MIXTURES

The classification of mixtures containing this substance results from Annex 1 of Regulation (EC) 1272/2008.

Reference: 99999

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

Precept label

Use safety goggles

Wear safety gloves

TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL (TA LUFT)

Chapter 5.2.5 Organic Substances, dust
To be treated as overall dust. The emissions of dust in the exhaust gas are not allowed to exceed the following values:

Mass flow: 0,20 kg/hr

or

Mass conc.: 20 mg/m³

The mass per unit volume of 0,15 g/m³ in exhaust gas is not allowed to be exceeded also on observance or lower deviation of a mass flow of 0,20 kg/h.

TRANSPORT REGULATIONS

UN Number: 3077
Shipping name: Environmentally hazardous substances, solid, n.o.s.
Hazard Identification Number: 90
Class: 9 (Miscellaneous items and materials)
Packing Group: III (low danger)
Danger Label: 9

Special labelling: Symbol (fish and tree)

Classification code: M7

Tunnel restrictions:
Passage allowed through all tunnels.

Reference: 01231

RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.

2 mg/m³
with reference to the inhalable fraction

Peak limitation: Excursion factor 2
Duration 15 min, mean; 4 times per shift; interval 1 hour
Category II - Substances with systemic effects

Risk of sensitization of skin

Pregnancy: Group D
Either there are no data for an assesment of damage to the embryo or foetus or the currently available data are not sufficient for classification in one of the groups A-C.

The reaction with nitrosation agents can result in the formation of the respective carcinogenic N-nitrosamines.
see section 'Metal-working fluids, hydraulic fluids and other lubricants'

DIRECTIVE 2012/18/EU (Seveso III)

The substance is subject to the hazard categories of the Hazardous Incident Ordinance:

E1 Hazardous to the aquatic environment, Category Acute 1 or Chronic 1

Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: E1
Hazardous to the aquatic environment
Qualifying quantity for the application of
Lower-tier requirements: 100 t
Upper-tier requirements: 200 t

TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

TRGS 201
Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Februar 2017, zuletzt geändert und ergänzt April 2018

TRGS 400
Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Juli 2017

TRGS 555
Betriebsanweisung und Information der Beschäftigten; Ausgabe Februar 2017

TRGS 600
Substitution; Ausgabe Juli 2020

TRGS 401
Gefährdung durch Hautkontakt, Ermittlung - Beurteilung - Maßnahmen; Ausgabe Oktober 2022

TRGS 500
Schutzmaßnahmen; Ausgabe September 2019

TRGS 509
Lagern von flüssigen und festen Gefahrstoffen in ortsfesten Behältern sowie Füll- und Entleerstellen für ortsbewegliche Behälter; Ausgabe Juni 2022

TRGS 510
Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar Dezember 2020

LINKS

International Limit Values
The MAK Collection for Occupational Health and Safety
DGUV Information 213-098: List of substances - lesson in schools (in German only)

REFERENCES

Quelle: 00438
Registry of Toxic Effects of Chemical Substances (RTECS)

Quelle: 00454
Hazardous Substances Data Bank (HSDB)

Quelle: 01231
GHS-Sicherheitsdatenblatt, Thermo Fisher Scientific
GHS Material Safety Data Sheet, Thermo Fisher Scientific

Quelle: 02071
Toxicological Data, compiled by the National Institute of Health (NIH), USA, selected and distributed by Technical Database Services (TDS), New York, 2009

Quelle: 02072
Ecotoxicological Data, compiled by the US Environmental Protection Agency (EPA), selected and distributed by Technical Database Services (TDS), New York, 2009

Quelle: 02090
ChemicalBook
www.chemicalbook.com

Quelle: 07520
Europäische Chemikalienagentur ECHA: Informationen über registrierte Substanzen
European Chemicals Agency ECHA: Information on registered substances

Quelle: 07619
DFG Deutsche Forschungsgemeinschaft: The MAK-Collection for Occupational Health and Safety, nach Veröffentlichungsdatum zu finden unter:
bis 2002 Verlag Chemie
ab 2002 Online: http://onlinelibrary.wiley.com/book/10.1002/3527600418/topics?filter=#
ab 2020 Online:
https://series.publisso.de/en/pgseries/overview/mak/dam/allContents/alphabetical

Quelle: 07742
British Industrial Biological Research Association "Toxicity Profiles" BIBRA Information Department, Carshalton

Quelle: 08013
Ludewig "Akute Vergiftungen" 9. Auflage, Wissenschaftliche Verlagsgesellschaft, Stuttgart 1999

Quelle: 08112
DFG Deutsche Forschungsgemeinschaft: MAK- und BAT-Werte-Liste 2023, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Mitteilung 59; GMS PUBLISSO

Quelle: 99983
Liste arbeitsmedizinisch-toxikologischer Standardwerke (2)
List of standard references regarding occupational health and toxikology (2)

Quelle: 99997
Projektgebundene arbeitsmedizinisch-toxikologische Literatur (1)
Project related bibliographical references regarding occupational health and toxikology (1)

Quelle: 99999
Angabe des Bearbeiters
Indication of the editor

Identification | Characterisation | Formula | Physical and chemical properties | Toxicology / Ecotoxikology | Occupational health and first aid | Regulations | Links | Literature register