

## Sulfuric acid



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### IDENTIFICATION

#### Sulfuric acid

Dipping acid

Spirit of vitriol

Vitriol oil

Sulfate of hydrogen

**ZVG No:** 1160  
**CAS No:** 7664-93-9  
**EC No:** 231-639-5  
**INDEX No:** 016-020-00-8

### CHARACTERISATION

#### SUBSTANCE GROUP CODE

120510 Acids, inorganic  
131000 Sulfur compounds, inorganic

#### STATE OF AGGREGATION

The substance is liquid.

#### PROPERTIES

colourless  
odourless

#### CHEMICAL CHARACTERISATION

Non-combustible substance.

Slightly viscous, strongly hygroscopic.

Mixable with water.

Aqueous solution reacts acidic.

Not volatile.

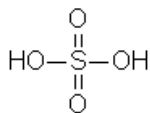
Acts oxidizing with increasing temperature. Concentrated sulphuric acid can destroy organic substances by dehydration under charring.

Acute or chronic health hazards result from the substance.

(see: chapter REGULATIONS).

[Substance information in Wikipedia](#)

## FORMULA



**Molar mass:** 98,08 g/mol

**Conversion factor** (gaseous phase) at 1013 mbar and 20 °C:

1 ml/m<sup>3</sup> = 4,08 mg/m<sup>3</sup>

## PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Vapour pressure](#) | [Solubility](#) | [Viscosity](#) | [Hazardous reactions](#)

### MELTING POINT

Melting point: 10,94 °C

100 %

Reference: [07520](#)

Melting point: 5 °C

99 %

Reference: [07520](#)

Melting point: -1,1 °C

98 %

Reference: [07520](#)

### BOILING POINT

Boiling Point: 290 °C

sulphuric acid 100 %

Reference: [00419](#) [01221](#) [07520](#)

Boiling Point: ca. 335 °C

sulfuric acid 98 % (azeotropic mixture with water)

Reference: [01211](#)

### DENSITY

DENSITY

Value: 1,84 g/cm<sup>3</sup>

Temperature: 20 °C

Reference: [01211](#)

## VAPOUR PRESSURE

The vapour pressure at room temperature is negligible ( $< 0.1$  Pa).

Reference: [99999](#)

## SOLUBILITY IN WATER

entirely mixable with water

Reference: [07796](#)

## VISCOSITY

Dynamic Viscosity: ca. 24 mPa\*s

Temperature: 20 °C

Conversion:  $\text{Viscosity(kin)} = \text{Viscosity(dyn)} / \text{density}$

Reference: [01211](#)

## HAZARDOUS REACTIONS

**Decomposition temperature:** 340 °C

**Hazardous chemical reactions**

Risk of explosion in contact with:

alkali/alkaline earth metals

combustible substances

potassium hydroxide

lye

sodium hydroxide

hydrogen peroxide

acetic aldehyde; acetonecyanhydrine; alkaline oxides (rare); alkyl nitrates (rare); ammonia solution;

ammonium iron(III) sulfate dodecahydrate (rare);

benzaldehyde-p-bromide phenyl hydrazone peroxide; benzyl alcohol (heat); bromates;

carbides; chlorates; chlorites; chlorosulfonic acid; cyclopentadiene;

diethylamine; 1,5-dinitronaphthalene;

alkaline earth hydroxides (rare); hydrofluoric acid; fulminates;

potassium tert-butoxide; permanganates; methyl ethyl ketone peroxide; sodium tetrahydroborate;

sodium oxide (rare); nitramide; nitrates (rare); o-nitroanilin (heat), nitromethane; N-

nitromethylamine; nitrotoluene;

perchlorates; perchloric acid (rare); permanganic acid (rare); picrates; 2-propen-1-ol; 2-propyn-1-ol;

mercury nitride; nitric acid + organic substances; trinitrotoluene

The substance polymerize in contact with:

1-chloro-2,3-epoxypropane

The substance can react dangerously with:

aluminium

organic substances

reducing agents

nitric acid

acetonitrile; acrolein/occlusion; acrylonitrile; aluminium; aminoethanol; conc. ammonia; aniline;

bromine pentafluoride;

calcium hydride; p-chloronitrobenzene + sulfur trioxide (heat); chlorine trifluoride; hydrogen

chloride/conc. sulfuric acid; 2-cyano-2-propanol; cyclopentanoneoxime (heat);

1,4-diazidobenzene; diethyl ether; p-dimethylaminobenzaldehyde; alkaline earth oxides; acetic

acid; acetic anhydride/inclusion;

ethylene cyanohydrin; ethylenediamine; synthesis; heat; copper; lithium silicide; highly flammable solvents;

metals/ diluted acid; 4-methylpyridine;

sodium carbonate; sodium thiocyanate; p-nitroacetanilide (heat); p-nitroaniline (heat); p-

nitroaniline sulfate (heat);

p-nitroanilinesulfonic acid (heat); m-nitrobenzenesulfonic acid;

phosphorus, red and white; phosphorus trioxide;

propene oxide; mercury; silver; tetramethylbenzene; 1,2,4,5-tetrazine; water/conc. sulfuric acid;

sugar

For oleum (fuming sulfuric acid) see ZVG-Nr. 520023

## TOXICOLOGY / ECOTOXICOLOGY

### TOXICOLOGICAL DATA

#### LD50 oral rat

Value: 2140 mg/kg

American Industrial Hygiene Association Journal. Vol. 30, Pg. 470, 1969.

Reference: [02071](#)

### ECOTOXICOLOGICAL DATA

#### LC50 Crustaceans (48 hours)

Minimum: 42,5 mg/l

Maximum: 42,5 mg/l

Median: 42,5 mg/l

Study number: 1

Reference for median:

Portmann, J.E., and K.W. Wilson 1971. The Toxicity of 140 Substances to the Brown Shrimp and Other Marine Animals. Shellfish Information Leaflet No.22 (2nd Ed.), Ministry of Agric.Fish.Food, Fish.Lab.Burnham-on-Crouch, Essex, and Fish Exp.Station Conway, North Wales :12 p.

Reference: [02072](#)

## OCCUPATIONAL HEALTH AND FIRST AID

[Routes of exposure](#) | [Toxic effects](#) |  
[First Aid](#)

### ROUTES OF EXPOSURE

#### Main routes of exposure

The intake of sulfuric acid (S.) is mainly to be expected via the inhalative pathway in the form of aerosols.[07619]

#### Respiratory tract

Because of the acid is strongly hygroscopic S. aerosols alter dependent on moisture. Whereas the particle size is 0.3 - 0.6 µm under normal environmental conditions, they increase to up to 10 - 15 µm in conditions of high moisture (mist). Aerosols inhaled are expected to absorb water in an analogous manner during their passage through the airways.

The hydrophilic S. aerosols condense preferentially in the upper respiratory tract. Generally, particles with a diameter of 10 - 15 µm are trapped mainly on the mucous membranes of the nose, those with a diameter of 1 - 10 µm mainly on the voice box, air tube and bronchi. Smaller aerosol particles can also reach the alveoles.[07619]

No studies on absorbability are available.

Generally, local reactions cause the main effects.[99983]

#### Skin

Following impact to the skin strong local effects are the main issue.[99983]

There is no indication of absorption of relevant amounts of S. via the intact skin.[07619]

#### Gastrointestinal tract

Absorbability via the gastrointestinal tract is assumed.[07636]

However, no studies on the kinetics of uptake are available.[99983]

### TOXIC EFFECTS

#### Main toxic effects

Acute:

Irritation up to chemical burns to the mucous membranes and skin,[07619]  
danger of serious damage to the eyes and lungs[07656]

Chronic:

Irritation to the eyes and airways, erosion of the teeth,[07619]  
damage to the skin[07748]

#### Acute toxicity

Concentrated S. differs considerably from dilute S. with regard to chemical properties and effects. Concentrated S. acts extremely destructively to organic material (through to carbonization) because of its strong affinity to water and high oxidation potential. By comparison, the action of dilute S. is equivalent to that of other inorganic acids of comparable acid strength (e.g. hydrochloric acid) and depends on the concentration of hydrogen ions.[07979]

Splashes of concentrated S. cause massive damage to the eyes through to blindness, possibly loss of the eyeball. Aerosols can also cause lacrimation, then serious inflammation and tissue damage to the eyes.[07619]

However, the chance of complete healing of eye injuries caused by dilute S. is considerably better. [07656]

In a test on rabbits' eyes 1 % S. did not produce permanent damage.[07979]

Concentrated S. causes serious chemical burns to the skin, similar to thermal burns. Typical symptoms are a dark discoloration and the formation of ulcers. Wounds heal slowly with scar formation. As for thermal burns, extensive chemical burns can become life threatening as a result of acute reactions to the heart/circulatory system (collapse, shock, consequences of shock). With increased dilution S. acts less aggressively.[07656]

10 % S. caused only minor irritation to the skin of volunteers (applied to the belly or shoulder). [07748]

The possibility of allergenic activity has not been studied.[99983]

After exposure to S. mists, the following typical symptoms were cited: sneezing, running nose, burning sensation in the throat, pain behind the breastbone, narrowness in the chest, cough, difficulty in breathing, also spasm of the vocal cords and bronchitis; at high concentrations also nosebleeding, coughing blood, conjunctivitis and mucosal inflammation of the stomach. Even after short-term impact long persisting damage to the airways and lung can result.[07619]

Very high concentrations were reported to have also caused immediate respiratory and cardiac arrest.[07606]

The results of the impact of low concentration are available from several studies on volunteers for 1 - 4 hours: For healthy volunteers changes to the lung clearance (initially increased clearance, then reduced activity) were concurrently determinable from 0.3 mg/m<sup>3</sup> upwards. Concentrations from 0.38 mg/m<sup>3</sup> upwards inhaled deeply under conditions of strong physical load, resulted in cough. Irritation to the throat appeared from 0.45 mg/m<sup>3</sup> upwards.

However, at concentrations up to 2 mg/m<sup>3</sup> no influence on the respiratory function was observable. From 3 mg/m<sup>3</sup> upwards bronchial constriction and wheezing in the lung were noticed. Asthmatics reacted at low concentrations with changes of their lung functions (juveniles from 0.035, adults from 0.35 mg/m<sup>3</sup> upwards). The irritation threshold was at the same concentration level as for healthy persons.[07619]

Generally, concentrations from about 7 - 10 mg/m<sup>3</sup> are considered to cause annoyance and 40 - 80 mg/m<sup>3</sup> to be intolerable.[07656]

However, the tolerability is also dependent on the particle size and habituation is possible.[07619]

Also following ingestion of S. mainly local damage determines the poisoning picture. Concentrated S. causes strong pain and vomiting of blackish masses. Tissues contacted mostly discolor darkly and show considerable swelling, later scabs. Early deaths resulting from chemical burns to the voice box (-> suffocation), acute reactions to the heart/circulatory system (reflex conditioned cardiac arrest or collapse, shock, consequences of shock) or rapid perforation of the stomach are possible.[07836]

Because the resulting coagulation necrosis initially forms an insulating layer, the injuries of the gullet and stomach (ulcers, perforation, stenosis and strictures) can possibly only become noticeable after a delay. Serious complications often even developed after several weeks.[07619]

Further findings which can influence the acute poisoning progress were found: disturbance to the acid-base balance (acidosis), because of this damage to the blood (hemolysis) and kidneys, possibly also damage to the liver. These effects are to be expected if large amounts of S. reach the blood stream either by absorption or via injured blood vessels.[99983]

The lethal dose is dependent on the concentration and exposure conditions (e.g. the level in the stomach).[07619]

1 - 5 ml of concentrated S. can cause death and perhaps even smaller amounts (a few drops). [07978]

After ingestion of very dilute acid relatively high doses were sometimes survived (allegedly 50 - 90 ml of 1 % S.).[07836]

## Chronic toxicity

Following repeated contact with the skin, dilute S. can cause mainly local damage. Inflammation on the skin, ulcers on the hands (in particular on the nail walls) as well as chronic purulent inflammation around the nail.[07656]

As possible secondary injuries from long-term impact of S. mists the following were specified: inflammation of the conjunctives, oral mucosa and gastric mucosa, discoloration and erosion of the teeth, irritation to the airways and inflammation of the skin.[07748]

Various studies on employees who were exposed to S. aerosols long term mainly reported irritation to the eyes and airways: burning sensation in the eyes, cough and very frequently irritation to the throat and nose (sneezing, dry nasal mucous membranes, running nose). In one of the studies the prevalence of these symptoms was higher than on control persons even at concentrations of less than 0.15 mg/m<sup>3</sup>.

In a study on workers exposed to S. during the manufacture of lead batteries, various parameters of the respiratory functions were examined. Only one of the parameters (FEV) was reduced. Exposure of these workers was estimated to be on average 0.2 mg/m<sup>3</sup>.

Because of the existence of mixed exposures, various further studies do not allow conclusions to be drawn on the concentrations at which irritation to the mucous membranes occurred.

In several studies the occurrence of damage to the teeth (abrasion and erosion) was also studied: A comparison of the prevalence of teeth erosion for employees from 2 battery manufacturing plants (exposures on average 0.45 and 0.1 mg/m<sup>3</sup>, respectively) with results of 35 % and 17 %, respectively for the persons exposed, showed significantly higher values than for a group of persons not exposed (4 %). No influence on the predisposition for tooth decay was determined. In studies on workers at battery manufacturing plants who were exposed to about 0.23 mg/m<sup>3</sup>, first tooth abrasion appeared after 4 months and tooth erosion after about 30 months. However, the authors suggested that even lower exposures could be sufficient to initiate such damage to the teeth.

In summary, it was estimated that the studies in working areas do not allow definite conclusions to be drawn regarding a tolerable concentration for long time periods.

The effects of long-term inhalation of S. aerosols were studied in numerous animal experiments. With regard to an effect threshold it is particularly relevant that rabbits and monkeys still showed slight histological changes to the airways after exposure to 0.25 - 0.38 mg/m<sup>3</sup>.

In a valid 28-day inhalative study recently carried out on rats, 0.3 mg/m<sup>3</sup> (LOAEL) caused minor damage only to the larynx. Nose and lungs remained without any findings.[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:

There is no reason to fear a risk of damage to the developing embryo or foetus when MAK and BAT values are observed.

Mutagenicity:

From various tests there was no indication of any primary genotoxic action or mutagenic action by S. in germ cells.

Carcinogenicity:

In case-control studies and cohort studies a connection between exposure to S. aerosols and the increased occurrence of laryngeal carcinoma was noticeable. However, in studies on animals neither carcinogenic nor tumor promoting effects could be determined. It is assumed that the laryngeal tumors observed on humans are to be attributed to the strong local irritative action by highly concentrated S. aerosols and, resulting from this, a regeneratively conditioned increase of the cell proliferation.[07619]

### **Biotransformation and excretion**

In in-vitro studies it was shown that the changes to the clearance and to the mucus caused by S. in the respiratory tract are to be attributed to the hydrogen ions, hence to the acidic action. The reaction of hydrogen ions with constituents of the mucus, or exceeding of the buffer capacity of the mucus, can lead to increased viscosity which is followed by a reduced ciliary function and ciliary clearance. Resulting from this, S. delays its own elimination from the lung and also that of other particles simultaneously inhaled.

Absorbed S. can be integrated into the physiological sulfate pool, surplus sulfate ions are eliminated preferentially with the urine.[07619]

### **Annotation**

This occupational health information was compiled on 05.11.2007.  
It will be updated if necessary.

**FIRST AID****Eyes**

As soon as possible:

Rinse the affected eye with widely spread lids for 10 minutes under running water whilst protecting the unimpaired eye.

Point the mild water jet directly into the eye in order to remove the acid residues as soon and as completely as possible.

Then, immediately transport the casualty to an eye doctor / to hospital.

Continue rinsing during the transport with isotonic saline solution, alternatively with water.

[00160]

**Skin**

Carry out the following measures as soon as possible: Remove casualty's contaminated clothing, take care to protect yourself.

Rinse skin areas affected under running water for 10 minutes.

Concentrated acid: As far as possible without delay, first blot concentrated acid with dry cloth or tissue paper (next best material) because on contact with water the acid reacts vigorously and under massive generation of heat. Immediately following or instead of this, rinse skin with a copious amounts of water (strong water jet or deluge shower).

Following extensive contamination, even in the case of dilute acid, use a deluge shower for decontamination if possible; otherwise rinse with copious amounts of water, using any means available.

Lay the casualty down in a quiet place and protect him against hypothermia.

Always take care for rapid medical treatment.

[08013]

**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.

For difficulty in breathing have the casualty take a semiupright position.

As soon as possible repeatedly have the casualty deeply breath a glucocorticoid inhalation spray in.

In serious cases it can be necessary:

If the casualty is unconscious but breathing lay him in a stable manner on his side.

If the casualty has stopped breathing give mouth to nose resuscitation. If this is not possible use mouth to mouth resuscitation. Keep his respiratory tract clear.

In case of cardiac arrest (no response and no normal breathing), immediately perform chest compressions and ventilation. If available, use Automated External Defibrillator (AED). The protection of the vital functions (respiration and circulation) takes priority over all other measures.

In the meantime call a physician to the site of the accident.

[80104, 07656, 00330, 07819]

**Swallowing**

Rinse the mouth and spit the fluids out.

If the casualty is conscious have him drink 1 glass of water (ca 200 ml).

Do not try to neutralize with bases and do not apply charcoal!

Do not make the casualty vomit.

Call a physician to the site of the accident.

During spontaneous vomiting hold the head of the casualty low with the body in a prone position in order to avoid penetration of the vomit into the airways.

[07750, 08013, 00160, 07638]

**Information for physicians**



- Symptoms of acute poisoning:

Eyes: pain, blepharospasm; irritation up to serious chemical burns, dependent on the concentration: danger of permanent opacity and ulceration of the cornea, loss of the eyeball;[07979] serious damage to the cornea also possible by aerosols[07619]

Skin: chemical burns to be expected at concentrations of more than 10 %;[00160] rapidly appearing corrosive injury like thermal burns (initially bleaching, then brown up to black discoloration, later ulceration, purulent inflammation); shock reaction[07656]

Inhalation: burning in the nose and throat, sneezing, narrowness in the chest, substernal pain, coughing (blood), dyspnoea, danger of laryngeal spasm, glottic edema, function disturbances/damage to the lung (abscess formation possibly only after a delay of several days) [07619]

Ingestion: painful chemical burns to the mucous membranes due to concentrated acid (dark discoloration of tissues contacted),[07836] however, signs of corrosion in the oronasal cavity can also be absent;[07978] mostly vomiting of dark masses; acute reactions to the heart/circulatory system as a consequence of chemical burns (collapse, shock, cardiac arrest);[07836] danger of perforation for the esophagus/stomach (mainly small curvature and prepyloric antrum are threatened);[07978] local effects through dilute acid are somewhat less pronounced;[07836] systemically possibly acidosis, lactic acidosis -> hemolysis/consequences of hemolysis -> disturbance of the kidney function, possible liver damage;[08013] late sequelae possibly even after weeks (in particular strictures and stenosis in the digestive system).[07619]

- Medical advice:

Immediately thoroughly rinse contaminated eyes and alleviate pain as necessary (for rinsing solutions: see "Recommendations"). Arrange further treatment by a specialist as soon as possible. [00160]

Continuously rinse contaminated skin with water or cleanse again with soap and water as needed. Do not make extensive use of dermatics with a locally anesthetizing effect. Prophylaxis for shock and tetanus as needed, further treatment in hospital.[08013]

Following inhalation of acid aerosols apply glucocorticoids inhalatively and intravenously as well as oxygen and carry out all further prophylactic measures for pulmonary edema and pneumonia. Check the functions of the respiratory system and heart/circulatory system.[07819]

For bronchial spasm apply bronchodilators.[07619]

Intubation, artificial ventilation and early tracheotomy can become necessary for respiratory insufficiency/glottic edema (stridor!).[07978]

Following ingestion of small amounts of the acid, immediate application of a liquid is recommended in order to achieve a rinsing effect.[07906]

Do not provoke vomiting under any circumstances do not apply charcoal. After ingestion of larger amounts of the acid, there are differing views on application of liquids (minor influence on the pH value but with possible simultaneous strong evolution of heat and increased probability of vomiting -> possibly leading to even stronger strain to the tissues).[07978]

In every case, first protect the vital functions.[08013]

For hypotension, infusion of isotonic electrolyte solution and a flat lying position are recommended in the first phase.[07978]

After ingestion also early prophylaxis for glottic edema with glucocorticoids, nasal intubation as needed.[07906]

In hospital, consideration should be given to drawing off content of the stomach via a thin, flexible tube (on an endoscopical base). The decision should be made dependent on the poisoning situation/findings (watch for a danger of perforation, no gastrolavage).[00160]

Besides inspection and treatment of the chemical burns, the following measures are the most important issues after hospitalization: determination/correction of the acid-base balance and blood gases, further treatment of pain and shock, check of the functions of the kidneys, liver, heart/circulatory system and lung, of the hemogram and coagulation status.[08013]

For strong hemolysis, hemodialysis or a whole blood transfusion is recommended.[00160]

## Recommendations

Provide the physician information about the substance/product and treatment already administered.

Immediate and urgent rinsing of the eyes is usually carried out with water. If available, further rinsing can take place with physiological saline solution, better with Ringer's lactate solution or (still better) BSS (balanced salt solution). These lachryma-isotonic, hypertonic rinsing solutions effectively prevent the formation of edema and damage of epithelium. However, it must be guaranteed that they are available immediately and are sterile (watch for the expiration date).  
[99996]

Opinions on the prophylactic use of steroids against strictures and stenoses are inconsistent.  
[07906]

### Annotation

This first aid information was compiled on 05.11.2007.

It will be updated if necessary.

## SAFE HANDLING

[Handling](#) | [Storage](#) | [Fire and explosion protection](#) | [Organisational measures](#) | [Personal protection](#) | [Disposal considerations](#) | [Accidental release measures](#) | [Fire fighting measures](#)

## TECHNICAL MEASURES - HANDLING

### Workplace

Provision of good ventilation in the working area.

Washing facility at the workplace required.

When handling excessive amounts of the substance an emergency shower is required.

Eye bath required. These locations must be signposted clearly.

### Equipment

Use closed apparatus if possible.

If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.

Label containers and pipelines clearly.

Suitable materials:

generally resistant:

Glass

Enamel

At lower temperatures:

Polyethylene PE

Polyvinyl chloride

Polypropylene PP

In different concentration- and temperature ranges, the resistance of metals may vary enormously.

Before choosing construction materials, search for distinct information.

Unsuitable materials:

non-noble metals

### Advice on safer handling

Take care to keep workplace clean and dry.

The substance must not be present at workplaces in quantities above that required for work to be progressed.

When mixing with water or organic liquids add concentrated sulphuric acid slowly under stirring and cooling if necessary.

Do not leave container open.

Sufficient ventilation must be guaranteed for refilling, transfer, or open use.

Avoid splashing.

Fill only into labelled container.

Avoid any contact when handling the substance.

Use an appropriate exterior vessel when transporting in fragile containers.

### **Cleaning and maintenance**

Use protective equipment while cleaning if necessary.

Only conduct maintenance and other work on or in the vessel or closed spaces after obtaining written permission.

## **TECHNICAL MEASURES - STORAGE**

### **Storage**

Do not use any food containers - risk of mistake.

Containers have to be labelled clearly and permanently.

Store in the original container as much as possible.

Do not use any metal containers.

Preferably use unbreakable containers rather than glass containers.

Place fragile vessels in break-proof outer vessels.

Keep container tightly closed.

Store in a cool place.

Store in a dry place.

Keep container in a well-ventilated place.

Store smaller vessels in cabinets with collecting tubs.

Substance is hygroscopic, protect from moisture.

### **Conditions of collocated storage**

Storage class 8 B (Non-combustible corrosive substances)

Only substances of the same storage class should be stored together.

Collocated storage with the following substances is prohibited:

- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive und explosive substances.
- Strongly oxidizing substances of storage class 5.1A.
- Organic peroxides and self reactive substances.

Under certain conditions the collocated storage with the following sub-stances is permitted (For more details see [TRGS 510](#)):

- Other explosive substances of storage class 4.1A.
- Pyrophoric substances.
- Substances liberating flammable gases in contact with water.
- Ammonium nitrate and preparations containing ammonium nitrate.

The substance should not be stored with substances with which hazardous chemical reactions are possible.

## **TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION**

### **Technical, constructive measures**

Substance is non-combustible. Select fire and explosion prevention measures according to the other used substances.

Inspect the electrical fittings regularly against the higher risk of corrosion.

## **ORGANISATIONAL MEASURES**

Instruction on the hazards and the protective measures using instruction manual ([TRGS 555](#)) are required with signature if just more than one minor hazard was detected.

Instruction must be provided before employment and then at a minimum of once per annum thereafter.

It must be assured that the workplace limit values are being maintained. If the limit values are exceeded, additional protection measures are necessary.

The measurements must be recorded and kept on file.

Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".

## PERSONAL PROTECTION

### Body protection

Depending on the risk, wear a sufficiently long apron and boots or a suitable chemical protection suit.

### Respiratory protection

In an emergency (e.g.: unintentional release of the substance, exceeding the occupational exposure limit value) respiratory protection must be worn. Consider the maximum period for wear.

Respiratory protection: Combination filter E - P2, colour code yellow-white.

Use insulating device for concentrations above the usage limits for filter devices, for oxygen concentrations below 17% volume, or in circumstances which are unclear.

### Eye protection

Sufficient eye protection must be worn.

Wear chemical safety goggles.

If the face is at risk a protective shield must also be worn.

If vapours or aerosols that may injure the eyes arise, then safety of the eyes can best be guaranteed by wearing a full mask.

### Hand protection

Use protective gloves. The glove material must be sufficiently impermeable and resistant to the substance. Check the tightness before wear. Gloves should be well cleaned before being removed, then stored in a well ventilated location. Pay attention to skin care.

Skin protection cremes do not protect sufficiently against the substance.

Textile or leather gloves are completely unsuitable.

The following information refers to 10% w/v and 25% w/v sulphuric acid:

The following materials are suitable for protective gloves (Permeation time  $\geq$  8 hours):

Natural rubber/Natural latex - NR (0,5 mm) (use non-powdered and allergen free products)

Polychloroprene - CR (0,5 mm)

Nitrile rubber/Nitrile latex - NBR (0,35 mm)

Butyl rubber - Butyl (0,5 mm)

Fluoro carbon rubber - FKM (0,4 mm)

Polyvinyl chloride - PVC (0,5 mm)

The following information refers to 50% w/v sulphuric acid:

The following materials are suitable for protective gloves (Permeation time  $\geq$  8 hours):

Polychloroprene - CR (0,5 mm)

Nitrile rubber/Nitrile latex - NBR (0,35 mm)

Butyl rubber - Butyl (0,5 mm)

Fluoro carbon rubber - FKM (0,4 mm)

Polyvinyl chloride - PVC (0,5 mm)

Following materials are unsuitable for protective gloves because of degradation, severe swelling or low permeation time:

Natural rubber/Natural latex - NR

The following information refers to 96% w/v sulphuric acid:

The following materials are suitable for protective gloves (Permeation time  $\geq$  8 hours):

Fluoro carbon rubber - FKM (0,4 mm)

Protective gloves of the following materials should not be worn longer than 2 hours continually (Permeation time  $\geq$  2 hours):

Butyl rubber - Butyl (0,5 mm)

Following materials are unsuitable for protective gloves because of degradation, severe swelling or low permeation time:

Natural rubber/Natural latex - NR

Polychloroprene - CR

Nitrile rubber/Nitrile latex - NBR

Polyvinyl chloride - PVC

The times listed are suggested by measurements taken at 22 °C and constant contact. Temperatures raised by warmed substances, body heat, etc. and a weakening of the effective layer thickness caused by expansion can lead to a significantly shorter breakthrough time. In case of doubt contact the gloves' manufacturer. A 1.5-times increase / decrease in the layer thickness doubles / halves the breakthrough time. This data only applies to the pure substance. Transferred to mixtures of substances, these figures should only be taken as an aid to orientation.

### **Occupational hygiene**

Foods, beverages and other articles of consumption must not be consumed at the work areas.

Suitable areas are to be designated for these purposes.

Avoid contact with skin. In case of contact wash skin.

Avoid contact with eyes. In case of contact rinse the affected eye(s).

Avoid inhalation of vapour or mist.

Avoid contact with clothing. Contaminated clothes must be exchanged and cleaned carefully.

Provide washrooms with showers and if possible rooms with separate storage for street clothing and work clothing.

The skin must be washed with soap and water before breaks and at the end of work. Apply fatty skin-care products after washing.

### **DISPOSAL CONSIDERATIONS**

Hazardous waste according to Waste Catalogue Ordinance (AVV).

If there is no way of recycling it must be disposed of in compliance with the respective national and local regulations.

Collection of small amounts of substance:

Inorganic acids and their anhydrides are, if necessary, first dilute or hydrolised by stirring cautiously in ice water. Then are neutralised with caustic lye; check pH value.

Place in collecting containers for salt solutions, adjust for a pH value of 6 - 8.

Collection vessels must be clearly labelled with a systematic description of their contents. Store the vessels in a well-ventilated location. Entrust them to the appropriate authorities for disposal.

### **ACCIDENTAL RELEASE MEASURES**

Evacuate area. Warn affected surroundings.

The hazardous area may only be entered once suitable protective measures are implemented. Only then can the hazardous situation be removed (see chapter Personal Protection).

Slip hazard through spilled sulphuric acid.

Take up with an absorbent (absorbent and neutralizer for spilled acids) and dispose of according to regulations.

Afterwards ventilate area and wash spill site.

Endangerment of watert:

Low hazard to waters. Inform the responsible authorities when very large quantities get into water, drainage, sewer, or the ground.

### **FIRE FIGHTING MEASURES**

#### **Instructions**

Substance is incombustible. Select fire fighting measures according to the surrounding conditions.

In case of ambient fire:

Cool surrounding containers with water spray.

If possible, take container out of dangerous zone.  
Rise in pressure and risk of bursting when heating.  
Contain vapours with water spray.

### Special protective equipment

In the case of inclusion in an ambient fire hazardous substances can be released.

Sulfur oxides

Wear self-contained breathing apparatus and special tightly sealed suit.

## REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Water hazard class](#) | [Transport Regulations](#) | [Threshold limit values](#) | [EC-Threshold limit values](#) | [MAK recommendations](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#)

## EUROPEAN GHS CLASSIFICATION AND LABELLING

### Classification

Corrosive to metals, Category 1; H290  
Skin corrosion, Category 1A; H314  
Serious eye damage, Category 1; H318



**Signal Word** "Danger"

### Hazard Statement - H-phrases

H290: May be corrosive to metals.  
H314: Causes severe skin burns and eye damage.

### Precautionary Statement - P-phrases

P280: Wear protective gloves/protective clothing/eye protection/face protection.  
P301+P330+P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.  
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water or shower.  
P305+P351+P338+P310: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

Manufacturer's specification by Sigma-Aldrich

Reference: [01221](#)

State: 2019

Checked: 2020

The substance is listed in appendix VI, table 3 of CLP regulation.  
The given classification can deviate from the listed classification, since this classification is to be complemented concerning missing or divergent danger classes and categories for the respective substance.

Reference: [99999](#)

## GHS-CLASSIFICATION OF MIXTURES

### Specific Concentration Limits

Skin Corr. 1A; H314: C  $\geq$  15 %  
Skin Irrit. H315: 5 %  $\leq$  C < 15 %  
Eye Irrit. 2; H319: 5 %  $\leq$  C < 15 %

The general concentration limits from Annex 1 of the Regulation (EU) 1272/2008 are to be used for possibly unspecified concentration ranges or further available substance classifications.

Reference: [07500](#)

### WORKPLACE LABELLING ACCORDING TO GERMAN [ASR A1.3](#)

#### Warning label



Caution - corrosive material

#### Precept label



Use safety goggles



Wear safety gloves

### GERMAN WATER HAZARD CLASS

Substance No: 182

WGK 1 - low hazard to waters

Classification according to the announcement of the list of substances hazardous to water in the Federal Register of 10.08.2017, last update 24.11.2023

### TRANSPORT REGULATIONS

UN Number: 1830

Shipping name: Sulphuric acid, with not less than 51 % pure acid

Hazard Identification Number: 80

Class: 8 (Corrosive Substances)

Packing Group: II (medium danger)

Danger Label: 8



Classification code: C1

Tunnel restrictions:

Passage forbidden through tunnels of category E.

Reference: [07902](#)

UN Number: 2796

Shipping name: Battery fluid, acid or Sulphuric acid with not more than 51 % pure acid

Hazard Identification Number: 80

Class: 8 (Corrosive Substances)

Packing Group: II (medium danger)

Danger Label: 8



Classification code: C1

Tunnel restrictions:

Passage forbidden through tunnels of category E.

Reference: [07902](#)

### **TRGS 900 - GERMAN OCCUPATIONAL EXPOSURE LIMIT VALUES**

0,1 mg/m<sup>3</sup>

with reference to the inhalable fraction

Peak limitation: Excursion factor 1

Duration 15 min, mean; 4 times per shift; interval 1 hour

Category I - Substances for which local irritant effects determine the exposure limit value, also respiratory allergens

There is no reason to fear a risk of damage to the developing embryo or foetus when AGW and BGW are adhered to.

Source: DFG, EU

Scope:

Sulfuric acid

### **EC OCCUPATIONAL EXPOSURE LIMIT VALUES**

Directive 2009/161/EU

**Recommended indicative occupational exposure limit value** for the European Union

A national occupational exposure limit value has to be set.

8 hours limit value: 0,05 mg/m<sup>3</sup> (mist)

### **RECOMMENDATIONS OF MAK-COMMISSION**

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

0,1 mg/m<sup>3</sup>

with reference to the inhalable fraction

Peak limitation: Excursion factor 1

Duration 15 min, mean; 4 times per shift; interval 1 hour

Category I - Substances for which local irritant effects determine the exposure limit value, also respiratory allergens

Carcinogenic: Category 4

Substances which are carcinogenic with no or minor genetically toxic effects. If there is a MAK-value for these substances no considerable contribution to the hazard of cancer will be expected.



Pregnancy: Group C

There is no reason to fear damage to the embryo or foetus when MAK and BAT values are observed.

A momentary value of 0,2 mg/m<sup>3</sup> should not be exceeded.

Scope: Sulfuric acid

## RESTRICTIONS OF USE / BANS OF USE

### REACH Regulation (EC) No 1907/2006 Annex XVII

Annex XVII, Point 3

1. The putting into circulation and the utilisation of the substance is not allowed in decorative objects, games and joke articles.

2. Substances labelled with H304 which can be utilised as fuels in decorative lamps and are put in circulation in amounts of 15 l or less must not contain a dye and/or a perfume.

Further information on prohibitions can be taken from the regulation.

Annex XVII, Point 75

Mixtures containing certain hazardous substances shall no longer be placed on the market for tattooing purposes. Mixtures containing such substances in specified concentrations shall no longer be used for tattooing purposes after 04.01.2022. Substances falling within one or more of the following points:

- carcinogenic or reproductive toxic substances according to Part 3 of Annex VI to CLP Regulation (excluding the classification due to effects only following exposure by inhalation),
- skin-sensitising, skin-corrosive, skin-irritant, serious eye-damaging or eye-irritant substances according to Annex VI Part 3 of the CLP Regulation,
- substances listed with specified conditions in Annex II or IV to Regulation (EC) No 1223/2009 [Cosmetics Regulation], and
- substances listed in Appendix 13 to Annex XVII (point 75) of the REACH Regulation.

In general, mixtures placed on the market for use for tattooing purposes must be labelled "Mixture for use in tattoos or permanent make-up." from 04.01.2022 on and may not be used for tattooing purposes without this labelling. Further safety information shall be provided on the packaging or in the instructions for use. Before using a mixture for tattooing purposes, the person using the mixture shall provide this information to the person undergoing the procedure.

Further information on the restrictions, concentration limits and exemptions can be taken from the Regulation.

Annex XVII to Regulation (EC) No 1907/2006, [consolidated version](#) (BAUA) (only in German)

### Consumer Goods Ordinance

Attachment 1 to § 3, Point 5

The substance must not be utilised for the production or treatment of joke articles.

### REGULATION (EU) 2019/1148 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the marketing and use of explosives precursors

The regulation shall apply from 1 February 2021.

The substance are not to be available to members of the general public, whether on their own or in mixtures that include this substance, unless the concentration is equal to or lower than the limit values set out in column 2. Suspicious transactions, loss and thefts of significant quantities are to be reported within 24 hours.

Further information can be taken from the regulation.

**Limit value: 15 % w/w**

**Upper limit value for the purpose of licensing under Article 5(3): 40 % w/w**

## 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 402](#)

Ermitteln und Beurteilen der Gefährdungen bei Tätigkeiten mit Gefahrstoffen: Inhalative Exposition; Ausgabe September 2023

### [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

## **REGULATIONS OF GERMAN ACCIDENT INSURERS**

### [DGUV Regel 112-190](#)

Benutzung von Atemschutzgeräten, Ausgabe November 2021  
(in German only)

## **LINKS**

### [International Limit Values](#)

### [OECD Screening Information DataSet \(SIDS\)](#)

### [The MAK Collection for Occupational Health and Safety](#)

### [DGUV Information 213-098: List of substances - lesson in schools \(in German only\)](#)

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Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärmedizin (BgVV):

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(Federal Institute for Health Protection of Consumers and Veterinary Medicine: Information index for the detection and treatment of poisoning)

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GHS Material Safety Data Sheet, Sigma-Aldrich

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European Chemicals Agency ECHA: Information on registered substances

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