

Ammonium sulfate

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IDENTIFICATION

Ammonium sulfate
Diammonium sulfate

ZVG No: 1470
CAS No: 7783-20-2
EC No: 231-984-1

CHARACTERISATION

SUBSTANCE GROUP CODE

128120 Ammonium salts
131400 Sulfates, hydrogensulfates, disulfates

STATE OF AGGREGATION

The substance is solid.

PROPERTIES

crystalline
colourless
odourless

CHEMICAL CHARACTERISATION

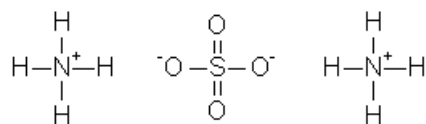
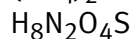
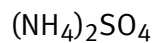
Non-combustible substance.
Freely soluble in water.
Chemically unstable at increased temperature.

[Substance information in Wikipedia](#)

DUST EXPLOSIVENESS

No risk of dust explosion.
Quelle: 99999

FORMULA



Molar mass: 132,14 g/mol

PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Density](#) | [Solubility](#) | [pH-value](#) | [Hazardous reactions](#)

MELTING POINT

The substance decomposes when heated (see decomposition temperature).

Reference: [01211](#)

DENSITY

DENSITY

Value: 1,77 g/cm³

Temperature: 20 °C

Reference: [01211](#)

SOLUBILITY IN WATER

Concentration: 754 g/l

Temperature: 20 °C

Reference: [01211](#)

pH-VALUE

pH-value: ca. 5

Temperature: 20 °C

Concentration: 100 g/l

Reference: [01211](#)

HAZARDOUS REACTIONS

Decomposition temperature: > 235 °C

Hazardous chemical reactions

Risk of explosion in contact with:

alkali chlorate/acid

alkali nitrate + potassium

alkali nitrate + potassium sodium alloy

alkali nitrate/acid

potassium nitrite

sodium hypochlorite

The substance can react dangerously with:

alkali chlorate/heat

alkali nitrate/heat

TOXICOLOGY / ECOTOXICOLOGY**ECOTOXICOLOGICAL DATA****LC50 Fish (96 hours)**

Minimum: 6,6 mg/l
Maximum: 4000 mg/l
Median: 365 mg/l
Study number: 34

Reference for median:

Knoph, M.B. 1992. Acute Toxicity of Ammonia to Atlantic Salmon (*Salmo salar*) Parr. *Comp.Biochem.Physiol.C* 101(2):275-282

LC50 Crustaceans (48 hours)

Minimum: 14 mg/l
Maximum: 14 mg/l
Median: 14 mg/l
Study number: 1

Reference for median:

Qureshi, A.A., K.W. Flood, S.R. Thompson, S.M. Janhurst, C.S. Inniss, and D.A. Rokosh 1982. Comparison of a Luminescent Bacterial Test with Other Bioassays for Determining Toxicity of Pure Compounds and Complex Effluents. In: J.G.Pearson, R.B.Foster and W.E.Bishop (Eds.), *Aquatic Toxicology and Hazard Assessment*, 5th Conference, ASTM STP 766, Philadelphia,PA :179-195

EC50 Crustaceans (48 hours)

Minimum: 59 mg/l
Maximum: 59 mg/l
Median: 59 mg/l
Study number: 1

Reference for median:

Manning, T.M., S.P. Wilson, and J.C. Chapman 1996. Toxicity of Chlorine and Other Chlorinated Compounds to Some Australian Aquatic Organisms. *Bull.Enviroin.Contam.Toxicol.* 56(6):971-976

Reference: [02072](#)

OCCUPATIONAL HEALTH AND FIRST AID

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

ROUTES OF EXPOSURE**Main routes of exposure**

Occupational exposure to ammonium sulfate (A.) is most likely to occur through inhalation of aqueous aerosols. [99999]

Respiratory tract

After inhalation, A. is dissolved on the mucous membranes of the respiratory tract, releasing ammonium and sulfate ions, which can be absorbed. Studies involving several species of test animals have shown that aerosols of A. composed of fine particles (with a diameter of 0.3 - 0.6 µm) are partially deposited in the nose but also reach the lungs, where they are rapidly absorbed into the blood (within 20 min). [435]

Likewise absorbed are the decomposition products ammonia, sulfur dioxide, sulfur trioxide and sulfuric acid [10417], which are released when A. is strongly heated. [99999]

Skin

No substance-specific information is available. [99998]

Due to the physico-chemical properties of A., a low dermal absorption is to be expected. Normal working conditions are not expected to result in the uptake of toxicologically relevant amounts of A. through the skin. [99999]

Gastrointestinal tract

In the event of oral intake, A. is effectively absorbed via the digestive tract. In the case of high doses (in the gram range) the percentage of sulfate absorbed decreases to about 30 - 40 % of the exposed dose. [435]

TOXIC EFFECTS

Main toxic effects

Acute:

mild irritation of eyes and previously damaged skin [435],

in the case of inhalation of thermal decomposition products, severe irritation of the respiratory tract, breathing difficulties and systemic toxic effects [99999, 10418],

if high oral doses are ingested, acidosis, gastrointestinal complaints [99999, 435].

Chronic:

if thermal decomposition products of A. have been inhaled, severe irritation of the airways and systemic toxic effects [99999].

Acute toxicity

In animal studies it has been shown that A. results in only mild local irritation:

50 mg of A., introduced as a powder into the eyes of rabbits and not washed out, caused slight reddening of the conjunctiva and mild swelling within one hour. After 24 hours, only a slight redness remained, and after 8 days all effects had subsided. [435]

On the skin of rabbits under semi-occlusive conditions, undissolved A. caused as little irritation after 20 hours of exposure as did an 80 % solution. After eight hours of exposure to the solid substance, only slight redness and swelling occurred on superficially injured rabbit skin, which completely subsided within 8 days. [435]

In humans, no evidence of a sensitising effect of A. exists. [99999]

Ammonium chloride, which is toxicologically comparable to A., elicited no sensitisation in two guinea pig maximisation tests (as per OECD Guideline 406). [7520]

Animal studies have revealed a low dermal toxicity. In limit tests in rats and mice, 2000 mg/kg bw as a solution in water/acetone applied to uninjured, uncovered skin was not lethal. Clinical symptoms were not reported (LD50 > 2000 mg/kg bw). [435]

In multiple inhalation studies involving volunteers who inhaled aerosols of A. (mean particle diameter up to 1 µm), no or at most minimal changes in functional breathing parameters, such as a slight decrease in exhalation rate, were observed after exposure to a maximum of 1 mg A./m³ for up to four hours. In these studies, asthmatics were not shown to be more sensitive than otherwise healthy subjects. [435]

Inhalation studies on laboratory animals exposed to nebulised aqueous solutions of A. also suggest a low toxicity: inhalative exposure of rats to inhalable aerosols (particle diameter 2 - 3 µm) revealed neither signs of toxic effects nor lethal effects after 8 hours of inhalation at 1000 - 1200 mg/m³. An LC50 (8 h inhalation, particle diameter 1 - 3 µm) of more than 900 mg/m³ was reported for guinea pigs. [435]

In guinea pigs, a slight increase in ventilatory resistance was observed after one hour of exposure to 0.5 - 9.5 mg A./m³ as an aqueous aerosol. In dogs, 4.1 mg A./m³ inhaled for four hours had no adverse effect on lung function. Studies involving a comparable range of concentrations in rabbits and rats revealed no impairment of the mucociliary clearance mechanism of the lung after one to four hours of exposure to 2.0 - 3.6 mg/m³ A. as an inhalable aerosol (particle diameter 0.4 µm). [7520, 435]

However, heating A. and inhalation of the vapour may potentially result in respiratory tract irritation and systemic toxic effects. When heated to temperatures above about 150 °C, A. initially decomposes primarily with the release of ammonia, while more intense heating also results in the formation of sulfur dioxide, sulfur trioxide and sulfuric acid. [10417, 435]

One case report describes severe poisoning of a worker exposed to the vapour released by heated A. (no information provided on concentration and duration of exposure). On admission to the emergency department, the affected individual lost consciousness and experienced convulsions, tachypnoea, cyanosis and metabolic acidosis. After intensive medical treatment involving intubation and treatment for acidosis, the patient recovered within eight days. [10418]

As with other ammonium salts of strong inorganic acids, oral ingestion of high doses of A. is likely to cause metabolic acidosis in addition to local irritation of the digestive tract. [99999] In one case of poisoning, ingestion of an unknown amount of A. resulted in the death of an 85-year-old individual. The concentration of ammonium ions in the blood was massively increased (250 mg/l, normal: 0.3 - 0.8 mg/l), and also to a lesser extent that of sulfate. With the exception of minor punctate haemorrhages of the gastric mucosa, neither burns of the mucous membranes nor changes in internal organs were observed. [435]

Sulfate ions are poorly absorbed in high doses in the digestive tract; they osmotically bind water in the intestinal lumen and hence, at higher doses, can lead to diarrhoea. [10419] After drinking an undisclosed quantity of A. dissolved in water at a concentration of 1500 - 2000 mg/l, a group of 18 people experienced gastrointestinal symptoms (acute dysentery) that subsided within 24 hours. [435]

Rabbits orally administered aqueous solutions of 1500 mg A./kg bw exhibited symptoms of poisoning within 70 minutes with pupillary dilation (mydriasis), irregular breathing, convulsions, EEG abnormalities and metabolic acidosis, and in the last event respiratory and cardiac arrest. The animals' blood was revealed to be acidotic and to contain high concentrations of ammonium and sulfate. Organ changes at histology were not observed. [435]

In standard toxicity tests involving oral exposure, an LD50 in the range of 2000 mg/kg bw was established in rats (no more precise information is available). In another experiment, at doses above 2500 mg/kg bw, apathy, impaired breathing and coordination, and subsequently discharge from the eyes and nose were observed (LD50: 4250 mg/kg bw). Similar LD50 values of > 2000 mg/kg bw and 3040 mg/kg bw have been reported for mice. [435]

Chronic toxicity

Occupational contact with A. does not appear to pose any significant risk to health. However, irritation and systemic effects cannot be ruled out if the decomposition products produced by heating A. are inhaled. [99999]

In studies involving animals, inhalation by rats for 14 days (8 h/d) to 300 mg A./m³ as an inhalable aerosol (mean particle size 1 - 2 µm) did not have adverse effects on lung function and volume, blood gases or histology of the trachea, lung and bronchial lymph nodes. Nor did a briefer exposure over three days to a higher aerosol concentration of 1000 - 1200 mg/m³ have any effect. [435] Oral exposure of rats for 13 weeks to 3 % A. in their feed (corresponding to approx. 1790 mg/kg bw per day) resulted in diarrhoea, although in the case of 1.5 % A. (approx. 890 mg/kg bw per day) this did not occur. No adverse changes in weight, in the histology of the internal organs, in clinical chemistry or haematological parameters were recorded. [435] Chronic administration of A. to rats for 52 weeks, up to a highest concentration of 3 % A. in the diet (approx. 1500 mg/kg bw per day), likewise did not result in any substance-related changes other than increased liver and kidney weights. [10419]

Reproductive toxicity, mutagenicity, carcinogenicity

Reproductive toxicity:

No substance-specific studies are available. [99998]

In a screening study on toxicity/reproductive toxicity (as per OECD Guideline 422), no impairment of fertility and developmental parameters was observed in rats administered aqueous solutions of diammonium hydrogenorthophosphate, which is toxicologically similar to A., up to the highest dose of 1500 mg/kg bw per day. [7520, 435]

Mutagenicity:

In vitro, A. was found to be non-mutagenic in the presence or absence of an exogenous metabolic activation system (S9 mix) in tests involving bacteria (Ames test) and in the HPRT test on mammalian cells (V79 cells). Furthermore, A. did not induce chromosomal aberrations in cytogenetic tests on human lymphocytes and Chinese hamster ovary cells (CHO cells). [10419, 435]

In vivo, ammonium chloride, a toxicologically comparable substance to A., was not found to be genotoxic in mice on the basis of the micronucleus test. [7520, 435]

Carcinogenicity:

Insufficient information is available in humans. [99998]

In animal studies involving rats, no carcinogenic effect was observed after administration of feed containing up to 3 % A. (corresponding to approx. 1500 mg/kg bw per day) for 104 weeks. [10419]

Biotransformation and excretion

In the body, ammonium ions are converted both to glutamine in a reaction with glutamic acid and into urea when combined with hydrogen carbonate in the urea cycle. These reactions are key to maintaining normal pH levels in the body. [10203]

A. is excreted in the form of ammonium and sulfate ions together with the urea formed in the urine. [10203, 10419]

Annotation

This occupational health information was compiled on 22.04.2021.

It will be updated if necessary.

This information was translated from German into English by Übersetzungsdienst Proverb.

FIRST AID

Eyes

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

Arrange medical treatment.

[99999, 7520]

Skin

Remove contaminated clothing while protecting yourself.

Cleanse the affected skin areas thoroughly with soap under running water.

In the event of contact with pre-damaged skin:

Arrange for medical treatment.

[99999, 7520]

Respiratory tract

Whilst protecting yourself remove the casualty from the hazardous area and take him to the fresh air.
In the case of breathing difficulties have the casualty inhale oxygen.
Arrange medical treatment.
In the event of exposure to the vapour / decomposition products released from heated A.:
In the meantime, summon an emergency physician.
[99999]

Swallowing

Rinse the mouth and spit the fluids out.
If the casualty is conscious have him drink 1 glass of water (ca 200 ml).
In case of spontaneous vomiting, keep the patient in a prone position with the head lower than the chest to prevent the vomit from penetrating the respiratory tract.
Arrange medical treatment.
[99999]

Information for physicians

- Symptoms of acute poisoning

Eyes: mild irritation [2110].

Skin: generally no irritation unless skin is already damaged [2110, 99999]

Inhalation: at most, mild irritation; inhalation of thermal decomposition products (ammonia, sulfur dioxide, sulfur trioxide and sulfuric acid) may cause severe irritation of the respiratory tract with breathing difficulties and systemic toxic effects (tachypnoea, cyanosis, metabolic acidosis, convulsions, pulmonary oedema and loss of consciousness) [2110, 10418, 99999]

Ingestion: irritation and pain in the gastrointestinal tract possible, as well as nausea, vomiting and diarrhoea, while in very rare cases involving ingestion of high oral doses, systemic effects may occur [2110, 99999]

Absorption: after high oral doses metabolic acidosis possible with vomiting, headache, restlessness, hyperreflexia, in rare cases up to areflexia, cyanosis, tachypnoea and respiratory disturbance (Kussmaul breathing), cardiac arrhythmia and coma. [8101, 99999]

- First medical assistance

After eye contact: following eye rinsing, consult an ophthalmologist [99999].

After skin contact: after rinsing with soap and water, no medical measures are usually required, except in the case of skin irritation, which requires symptomatic therapy. [99999]

After inhalation: if required, administration of a short-acting β -2 sympathomimetic spray and inhalation of a muscarinic receptor antagonist such as ipatropium bromide; in the event of inhalation of the vapour/decomposition products released from heated ammonium sulfate, inpatient monitoring of cardiovascular function, as well as acid-base balance, symptomatic therapy [10014, 99999]

After ingestion: after drinking water, gastroscopy if necessary, inpatient medical monitoring of cardiovascular function, as well as kidney and liver parameters and acid-base balance, symptomatic therapy [8101, 99999]

Recommendations

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

Annotation

This first aid information was compiled on 17.07.2021.

It will be updated if necessary.

This information was translated from German into English by Übersetzungsdienst Proverb.

SAFE HANDLING

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

TECHNICAL MEASURES - HANDLING

Workplace

Select ventilation measures according to the other used substances.

If there is a chance that dusts may be released, then the work room must provide adequate ventilation.

Washing facility at the workplace required.

Equipment

Suction off dust at the point of exit.

Consider emission limit values, a purification of waste gases if necessary.

Containers are to be marked clearly.

Advice on safer handling

Do not leave container open.

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

Fill only into clearly marked containers.

Avoid rising dust.

Cleaning and maintenance

Avoid dust formation. Dust formation that cannot be avoided must be collected regularly.

Use a tested industrial vacuum cleaner or suction device.

Do not raise dust while cleaning.

Use of a blower for cleaning is not permitted.

Alternative: clean damp.

TECHNICAL MEASURES - STORAGE

Storage

Do not use any food containers - risk of mistake.

Containers have to be marked clearly and permanently.

Keep container tightly closed.

Store in a dry place.

Conditions of collocated storage

Storage class 10 - 13 (Other liquids and solids)

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.

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

- Gases.
 - Flammable liquids of storage class 3.
 - Other explosive substances of storage class 4.1A.
 - Pyrophoric substances.
 - Substances liberating flammable gases in contact with water.
 - Oxidizing substances of storage class 5.1B.
 - Ammonium nitrate and preparations containing ammonium nitrate.
 - Organic peroxides and self reactive substances.
 - Combustible and non combustible acutely toxic substances of storage classes 6.1A and 6.1B.
- 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.

PERSONAL PROTECTION

Body protection

Wear an apron or a lab coat.

Respiratory protection

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

Respiratory protection: Particle filter P1, colour code white.

Eye protection

Wear glasses with side protection.

Hand protection

If protective gloves are used, the following materials are recommended:

The following information is valid for aqueous, saturated solutions of the substance.

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 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

Take heed of usual occupational hygiene measures when handling chemical substances, especially wash the skin with soap and water before breaks and at the end of work and apply fatty skin-care products after washing.

DISPOSAL CONSIDERATIONS

Non-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:

Collect in container for inorganic solids.

Neutral solutions (pH-control):

Place in a collection container 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

Wear a dust mask.

Pick up without creating dust.

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.

Special protective equipment

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

Nitrous gases (nitric oxides)

Sulfur oxides

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

REGULATIONS

[GHS Classification/ Labelling](#) | [Water hazard class](#) | [Air quality control](#) | [Transport Regulations](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#)

EUROPEAN GHS CLASSIFICATION AND LABELLING

Not a dangerous substance according to GHS.

Manufacturer's specification by Sigma-Aldrich

Reference: [01221](#)

State: 2021

Checked: 2021

GERMAN WATER HAZARD CLASS

Substance No: 296

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

TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL (TA LUFT)

Chapter 5.2.1 Overall Dust, including fine 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

Not subject to transport regulations.

Reference: [01221](#)

RESTRICTIONS OF USE / BANS OF USE

REACH Regulation (EC) No 1907/2006 Annex XVII

Annex XVII, Point 65. Inorganic ammonium salts

Shall not be placed on the market, or used, in cellulose insulation mixtures or cellulose insulation articles after 14 July 2018 unless the emission of ammonia from those mixtures or articles results in a concentration of less than 3 ppm by volume (2,12 mg/m³) under the test conditions specified in paragraph 4.

Further information on prohibitions and exceptions can be taken from the regulation.

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

TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

[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

[OECD Screening Information Data Set \(SIDS\)](#)

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

REFERENCES

Quelle: 00001

IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)

Data acquisition and maintenance manual of the GESTIS substance database (non-public)

Quelle: 00435

Organisation for Economic Cooperation and Development (OECD) "Screening Information Data Set for High Production Volume Chemicals (SIDS)", <http://www.inchem.org/pages/sids.html>

Quelle: 01211

GHS-Sicherheitsdatenblatt, Merck

GHS Material Safety Data Sheet, Merck

Quelle: 01221

GHS-Sicherheitsdatenblatt, Sigma-Aldrich

GHS Material Safety Data Sheet, Sigma-Aldrich

Quelle: 02072

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

Quelle: 02110

National Center for Biotechnology Information:

PubChem

<https://pubchem.ncbi.nlm.nih.gov/>

Quelle: 05300

[TRGS 510](#) "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Dezember 2020

Quelle: 06002

L. Roth, U. Weller

"Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag
("Dangerous chemical reactions" loose-leaf collection with supplement deliveries)

Quelle: 07520

Europäische Chemikalienagentur ECHA: Informationen über registrierte Substanzen

European Chemicals Agency ECHA: Information on registered substances

Quelle: 07580

Bekanntmachung der Liste der wassergefährdenden Stoffe im Bundesanzeiger vom 10.08.2017,
zuletzt geändert 24.11.2023

Quelle: 07795

H. Geerßen "GloSaDa 2000 Plus - Glove Safety Data"

Quelle: 08101

Reinhard Ludewig, Ralf Regenthal:

Akute Vergiftungen und Arzneimittelüberdosierungen,
11. Auflage,

Wissenschaftliche Verlagsgesellschaft Stuttgart, 2015

Quelle: 10014

Walker et al.

Diagnosis and management of inhalation injury: an updated review.

Critical Care (2015) 19:351

Quelle: 10203

L. Thomas: Clinical Laboratory Diagnostics. TH-Books Verlagsgesellschaft mbH, Frankfurt/Main. 1st
English edition (1998). ISBN 3-9805215-4-0

Quelle: 10417

R. Kiyoura, K. Urano: Mechanism, Kinetics, and Equilibrium of Thermal Decomposition of Ammonium
Sulfate. Industrial & Engineering Chemistry Process Design and Development, 1970, 9(4), 489-494

Quelle: 10418

Ö. Köksal, M. Almacioglu, F. Ozdemir, M. Bulut, S. Aydin: A Case Report of Ammonium Sulfate
Inhalation. Journal of Academic Emergency Medicine, 2011, 180(2), 180-182

Quelle: 10419

EFSA Panel on Food Additives and Flavourings, M. Younes, G. Aquilina, et al.: Re-evaluation of
sulphuric acid and its sodium, potassium, calcium and ammonium salts (E 513, 514 (i), 514 (ii), 515
(i), 515 (ii), 516 and 517) as food additive. EFSA Journal, 2019, 17(10), e05868

Quelle: 99998

Liste arbeitsmedizinisch-toxikologischer Standardwerke (3)

Quelle: 99999

Angabe des Bearbeiters

Indication of the editor

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content, whatever the legal cause may be.**