IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

Dipotassium disulfite

IDENTIFICATION

Dipotassium disulfite
E 224
Potassium disulfite
Potassium pyrosulfite

ZVG number:	3160
CAS number:	16731-55-8
EC number:	240-795-3

CHARACTERISATION

SUBSTANCE GROUP CODE

122300	Potassium compounds
131300	Sulfites, hydrogen sulfites, disulfites

STATE OF AGGREGATION

The substance is solid.

PROPERTIES

Form:	powder
Colour:	white
Odour:	faint smell of sulfur dioxide

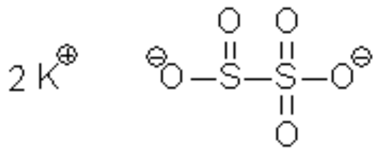
CHEMICAL CHARACTERISATION

Non-combustible solid.
Freely soluble in water.
Aqueous solution reacts acidic.
Acute or chronic health hazards result from the substance.
(see: chapter REGULATIONS).

FORMULA

K2S2O5

K2O5S2



Molar mass: 222,33 g/mol

PHYSICAL AND CHEMICAL PROPERTIES

MELTING POINT

The substance decomposes when heated (see decomposition temperature).

DENSITY

DENSITY

Value:	2,34 g/cm^3

BULK DENSITY

Value:	1000 ... 1300 kg/m^3

SOLUBILITY IN WATER

Concentration:	450 g/l
Temperature:	20 °C

pH-VALUE

pH-value:	3,0 ... 4,5
Temperature:	20 °C
Concentration:	50 g/l

PARTITION COEFFICIENT (octanol/water)

log Kow:	-4

HAZARDOUS REACTIONS

Decomposition temperature:	> 150 °C

Decompositon products:
Sulphur dioxide

Hazardous chemical reactions:

The substance can react dangerously with:
acids
oxidizing agents
nitrites; nitrates; sulfides;

OCCUPATIONAL HEALTH AND FIRST AID

ROUTES OF EXPOSURE

Main Routes of exposure:

During occupational handling of potassium metabisulfite (P.) exposure is possible via the inhalative and dermal pathway.
No data is available on which is the main intake pathway.[07619]

Respiratory tract:

No substance specific kinetic studies are available.[99983]
For the well comparable sodium metabisulfite it was found that particles with a diameter of 0.1 up to 10 μm are precipitated in the main on the nasal mucosa and to a minor extent in areas of the air tube and bronchi. Only a very small part reached the lung.[00220]
Aqueous metabisulfites are transferred to the corresponding bisulfite which in its turn is in a pH dependent equilibrium with sulfite and hydrated sulfur dioxide.[07619]
Therefore, the absorption mainly in the upper respiratory tract demonstrated for sulfur dioxide is also to be assumed for metabisulfites.[99999]

Skin:

No data on the penetrability of P. through the skin is available.[99983]

Gastrointestinal tract:

Sodium metabisulfite orally applied to rats was nearly completely absorbed in the gastrointestinal tract.[00418]
Therefore, effective absorption of P. is also to be assumed.[99999]

TOXIC EFFECTS

Main toxic effects:

Acute:
Irritation to the eyes and airways,[00220]
acute intolerance reactions[07619]
Chronic:
allergic skin reactions (seldom)[07742]

Acute toxicity:

As for comparable sulfite salts, P. is expected to be irritating to the mucous membranes.[00220]
Data confirming this are only available from a few animal experiments.[99983]
In a standardized test on rabbits' eyes (according to OECD guideline 405) distinct irritation was ascertained.
By comparison, no skin irritative effect was determinable on rabbits (in only one test).[00220]
No conclusive tests on the skin sensitizing potential are available.[99983]
See "Chronic toxicity" for information on possible allergic skin reactions.
Based on experience available for sodium bisulfite and sodium metabisulfite, mainly irritation to the upper respiratory tract is to be expected following inhalative exposure.[99999]
The first reaction of mice exposed to sodium metabisulfite was sensory irritation to the upper airways to an extent comparable to that of sulfur dioxide.[07742]
For P. itself it was only reported that rats tolerated an atmosphere enriched with dusts for 8 hours without deaths.

Analogous to sodium bisulfite and sodium metabisulfite, the oral toxicity in animal experiments was relatively low (LD50, rat: 1800 or 2300 mg P./kg bw).[00220]
For humans, following ingestion of sodium bisulfite in gram doses gastrointestinal disturbances (nausea, vomiting, diarrhoea) were reported.[07748]
Although the toxicity is generally low, there is a risk for certain predisposed persons (often asthmatics) for whom small doses of bisulfites/sulfites can cause acute hypersensitivity reactions.[07742]
These immediate reactions were frequently observed after oral intake of foods treated with sulfites (mostly sodium metabisulfite and P.), less often after inhalation or other uses of sulfite containing formulations/medicaments: bronchospasm or asthma mostly appeared within from some minutes up to 1 hour.[99983]
Generalized skin eruptions (urticaria), running nose, swelling of the nasal mucosa and other anaphylactoid reactions (gastrointestinal disturbances, angioedema, swelling of the voice box, strong hypotension or shock) were found less often.
In provocation tests, sulfite-sensitive persons reacted to even small doses (orally to a few mg P., inhalatively to aerosols of a 1 % solution) and showed narrowing of the airways or asthma reactions.[07742]
The pathogenesis of these reactions is unknown, however, an immunological mechanism is suspected only for a minority of persons concerned.[07619]

Chronic toxicity:

During occupational exposure to sodium bisulfite and sodium metabisulfite, irritation to the eyes and airways are generally estimated to be the significant effects.[07748]
This should also be relevant for the well comparable P. However, no information on an effective threshold is available either from studies in working areas or from animal experiments.[99983]
During occupational handling of sodium metabisulfite and P., allergically conditioned skin diseases developed in single cases. The allergic genesis of contact dermatitis and eczema diagnozed for the persons concerned was determinable through positive patch test reactions.
In a standardized test series on 2894 unselected skin patients 50 (1.7 %) reacted positively both to 1 % P. and also to 1 % sodium metabisulfite or to 1 % as well as 5 % sodium bisulfite in petrolatum. In 12 cases a connection with exposure to sulfites was determinable. Summarizing, a significant sensitizing potential is not assumed because allergic reactions occur seldom in view of the extensive use of bisulfites and sulfites.[07619]
In connection with the use of P. and other sulfites to preserve food, long-term effects following oral intake were extensively studied in animal experiments.[00220]
Besides local irritation in the gastrointestinal tract some systemic effects were observed. However, the significant reason for these effects is not considered to be the toxicity of the sulfite itself but rather the decrease of

the vitamin B1 content in the food due to sulfites or the formation of toxic products as a result of reactions with food constituents.

The WHO estimated a long-term tolerable daily dose (ADI value) of 0.7 mg/kg bw (as SO2 equivalent) for sulfites, including P. permitted as food additives.[07742]

Because of the specificity of the toxic effects (see above) after oral intake this value is hardly relevant for other exposure pathways.[99999]

Regardless of this, for persons with a genetically conditioned sulfite oxidase deficiency a particular sensitivity for possible systemic effects is assumed.[07748]

Reproductive toxicity, Mutagenicity, Carcinogenicity:

Reproductive toxicity:

Animal experiments available for P. did not provide conclusive indications of reproductive-toxic effects.

Mutagenicity:

From microbiological tests, in-vitro tests on mammalian cells and cytogenetic tests in vitro and in vivo the predominant portion of the results was negative.[00220]

Carcinogenicity:

Insufficient data is available.[99983]

Biotransformation and Excretion:

Dependent on the degree of dilution, aqueous P. is increasingly transferred into bisulfite which for its part is in a pH dependent equilibrium with sulfite and (hydrated) sulfur dioxide. Therefore, once absorbed (under physiological pH conditions) nearly analogous behavior for these compounds is assumed.[07742]

Sulfite orally taken in by rats was already partially oxidized during transport from the stomach to the intestines.

Bisulfites/sulfites which have reached the blood stream are oxidized to form sulfate by means of sulfite oxidase (mainly occurring in the liver but also in the kidneys, spleen, lung, brain and heart). Some other, unspecific enzymes are also capable of oxidizing sulfites.[99996]

Sulfate formed can be integrated into the physiological sulfate pool, the surplus is eliminated with the urine.[07619]

The sulfite clearance is high for rats, proportionately lower for rabbits and monkeys. This is attributed to the activity differences of sulfite oxidase. Because this is also low for humans, the rat seems to have only limited applicability as an animal model.[07748]

Annotation:

This occupational health information was compiled on 02.07.02.

It will be updated if necessary.[99999]

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.

Skin:

Remove contaminated clothing while protecting yourself.

Immediately cleanse the affected skin areas with soap under running water.
Arrange medical treatment.

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.
If signs of difficulty in breathing or irritation appear:[99999]
As soon as possible repeatedly have the casualty deeply breath a glucocorticoid inhalation spray in.
Arrange medical treatment.

Swallowing:

Rinse the mouth and spit the fluids out.
If the casualty is conscious have him drink copious amounts of liquids (water).
Do not make the casualty vomit.
Arrange medical treatment.
During spontaneous vomiting hold the head of the casualty low with the body in a prone position in order to avoid penetration of vomit into the air tube.[07638]

Information for physicians:

Following contact with potassium metabisulfite, irritation to the eyes, upper airways and other mucous membranes is in general the significant effect to be expected.[00220]
However, acute hypersensitivity reactions to sulfite-sensitive persons can take place and these can become acutely life threatening.[07742]
The following statement takes data available for sodium bisulfite and sodium metabisulfite into consideration.[99999]
- Symptoms of acute poisoning:
Eyes: irritation to the conjunctives, possible cornea opacity,[00220]
in single cases hypersensitivity reactions (see below)[07742]
Skin: following short-term contact, in general weak/no irritation,[00220]
seldom allergic skin reactions (dermatitis/eczema)[07619]
Inhalation: concentration dependent irritation mainly to the upper respiratory tract, also bronchoconstriction,[07748]
in extreme cases lung damage not to be excluded;[00418]
for sulfite-sensitive persons mostly within minutes up to 1 hour: bronchospasm, asthma attacks, seldom urticaria, swelling of the nasal mucosa, angioedema, glottic edema, gastrointestinal symptoms, hypotension and shock[07742]
Ingestion: following intake of high doses irritation to the mucous membranes and gastrointestinal complaints (nausea, vomiting);
possibly also systemic effects;[00220]
for sulfite-sensitive persons immediate reactions (like those described under inhalation), even after mg doses[07742]
Absorption: possible reactions to the heart/circulatory system and CNS disturbances[00220]
- Medical advice:
Thoroughly rinse contaminated eyes even if only minor irritation is felt. Check/further treatment by an ophthalmologist is recommended.
Carefully cleanse contaminated skin. Further treatment probably is hardly necessary. For irritation a dermatocorticoid should be applied.[99999]
If signs of irritation or bronchoconstriction appear after inhalation, application of glucocorticoids (inhalatively/

intravenously) and oxygen is required. Check functions of the heart/circulatory system.[00022]
For bronchospasm apply bronchodilators.[07619]
Intubation, artificial ventilation and possibly also early tracheotomy can be required for respiratory insufficiency/glottic edema. These are to be expected if there is a serious sensitivity against sulfites.
Further treatment should be done symptomatically.[99999]
Following ingestion have the casualty drink rather a lot of water.[00418]
Do not provoke vomiting, do not apply charcoal.
Following ingestion of high doses, after reviewing all findings consideration can be given to drawing the stomach contents off via a soft, flexible tube.
For hypersensitivity reactions (respiratory insufficiency, asthma, anaphylactoid reactions) use similar measures as for inhalation (see above).
Following oral poisoning, massive inhalation or for hypersensitivity reactions protect the vital functions and transport the casualty to hospital as soon as possible.[99999]

Recommendations:

Provide the physician information about the substance/product and treatment already administered.
The therapy of sulfite induced asthma with antihistaminic agents was ineffective.
Bronchoconstriction induced by bisulfites was reported not to be prevented certainly by intravenous application of atropine.[07619]

Annotation:

This first aid information was compiled on 02.07.02.
It will be updated if necessary.[99999]

HANDLING AND USAGE

USAGE

The substance is used as:
- preserving agent, antioxidant and stabilizer in food
- preserving agent in developers and stop baths

The substance is used in:
- must and wine production
- photography to acidify fixing baths

TECHNICAL MEASURES - HANDLING

Workplace:

Provision of good ventilation in the working area.
Washing facility at the workplace required.

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.
Consider emission limit values, a purification of waste gases if necessary.
Label containers and pipelines clearly.

Advice on safer handling:

Take care to maintain clean working place.
Do not leave container open.
Sufficient ventilation must be guaranteed for refilling, transfer, or open use.
Avoid spillage.
Fill only into labelled container.
Avoid rising dust.

Cleaning and maintenance:

Use protective equipment while cleaning if necessary.
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.

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.
Keep container tightly closed.
Storage temperature: Without any limitation.
Store in a dry place.
Protect from overheating/heating up.

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.
- Spontaneously flammable 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 stora-ge 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.

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

PERSONAL PROTECTION

Body protection:

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

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: Combination filter B - P2 or B - P3, colour code grey-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.

Hand protection:

The use of resistant protective gloves is recommended.
Skin protection cremes do not protect as effectively against the substance as protective gloves.
Therefore suitable protective gloves should be preferred as far as possible.
The following information is valid for aqueous, saturated solutions of the salt.
The following materials are suitable for protective gloves (Permeation time >= 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.

Industrial 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 eyes. In case of contact rinse the affected eye(s).
Avoid inhalation of dust.
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:
Feed in sodium hypochlorite solution with agitation, if necessary react several days. Attention, some substances may react vigorously! Possibly discharge liberated toxic or flammable gases. Any excess of the oxidizing agent are destroyed with sodium thiosulphate.
Place in a collection container for salt solutions, adjust for a pH value of 6-8, or
place in a collection container for poisonous inorganic residues as well as heavy-metal salts and their solutions.

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 respiratory protection, eye protection, hand protection and body protection (see chapter Personal Protection).
Carefully sweep up, gather and remove. Avoid rising 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.
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:

Ambient fire may liberate hazardous vapours or decomposition products.
Sulphuric oxides
Wear self-contained breathing apparatus.

REGULATIONS

Classification:

Serious eye damage, Category 1; H318
Specific Target Organ Toxicity (single exposure), Category 3; H335

Signal Word: "Danger"

Hazard Statement - H-phrases:

H318: Causes serious eye damage.
H335: May cause respiratory irritation.

Supplemental Hazard Statement - EUH-phrases:

EUH031: Contact with acids liberates toxic gas.

Precautionary Statement - P-phrases:

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.
P313: Get medical advice/attention.

Manufacturer's specification by Merck

Source: 01211

GHS-CLASSIFICATION OF MIXTURES

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

Source: 99999

EUROPEAN CLASSIFICATION

Xi Irritant

Risk phrases (R-phrases):

R 31	Contact with acids liberates toxic gas
R 37	Irritating to respiratory system
R 41	Risk of serious damage to eyes

Manufacturer's specification by Merck

Source: 01211

WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

The workplace labelling still refers to the old hazard classification, because ASR A1.3 has not yet been converted to GHS.

Warning label:

Caution - harmful or irritant material

Precept label:

Use safety goggles

GERMAN WATER HAZARD CLASS

Substance No: 2863

WGK 1 - low hazard to waters

Classification according to Annex 3 of the Administrative Regulation of Substances Hazardous to Water (VwVwS)

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 concentration: 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.

RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.
Scope: Sulfites
see section 'Sensitizing substances'
Causes pseudoallergic reactions.

Source: 08097

RESTRICTIONS OF USE / BANS OF USE

Directives on Safety in School (BGR/GUV-SR 2003)

Activity ban for pupils till grade 4 (form) inclusive.
Substance list to GUV-SR 2004 (as of 11.2010)

FURTHER REGULATIONS

TRGS 200
Einstufung und Kennzeichnung von Stoffen, Zubereitungen und Erzeugnissen; Ausgabe Oktober 2011

TRGS 201
Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Oktober 2011

TRGS 400
Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Dezember 2010; geändert und ergänzt September 2012

TRGS 555
Betriebsanweisung und Information der Beschäftigten; Ausgabe Januar 2013

TRGS 600
Substitution; Ausgabe August 2008
TRGS 500
Schutzmaßnahmen; Ausgabe Januar 2008, ergänzt Mai 2008

TRGS 510
Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Oktober 2010

REFERENCES

Quelle: 00001
IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)

Quelle: 00022
G. Hommel "Handbuch der gefährlichen Güter" Loseblattsammlung mit Ergänzungslieferungen, Springer-Verlag, Heidelberg

Quelle: 00220
IUCLID-CD-ROM, Year 2000 edition; European Commission, Joint Research Centre, Institute for Health and Consumer Protection, European Chemicals Bureau; Ispra, Italy

Quelle: 00418
HSDB-Datenbankrecherche 2002

Quelle: 00500
RÖMPP Online ab 2003

Quelle: 01010

Merck Millipore: Chemicals Database
http://www.merckmillipore.com/chemicals

Quelle: 01210
Sicherheitsdatenblatt der Firma Merck

Quelle: 01211
GHS-Sicherheitsdatenblatt der Firma Merck

Quelle: 01221
GHS-Sicherheitsdatenblatt der Sigma-Aldrich-Gruppe

Quelle: 01240
Sicherheitsdatenblatt der Firma Acros

Quelle: 01270
Sicherheitsdatenblatt der BASF

Quelle: 05000
Kühn-Birett-Gruppenmerkblätter

Quelle: 05300
TRGS 510 "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Oktober 2010

Quelle: 07504
Erste Allgemeine Verwaltungsvorschrift zum Bundesimmissionsschutzgesetz (Technische Anleitung zur Reinhaltung der Luft - TA Luft) vom 24.07.2002, GMBl. 2002, Heft 25 - 29, S. 511 - 605.

Quelle: 07520
Europäische Chemikalienagentur ECHA: Informationen über registrierte Substanzen

Quelle: 07586
Einstufung nach Anhang 3 der Verwaltungsvorschrift wassergefährdender Stoffe; UBA; Stand 03.04.2013

Quelle: 07619
DFG: Toxikologisch-arbeitsmedizinische Begründungen von MAK-Werten; Verlag Chemie

Quelle: 07635
AUERDATA 98 und BGR/GUV-R 190 "Einsatz von Atemschutzgeräten" Ausgabe 11/2009

Quelle: 07638
M. Daunderer "Toxikologische Enzyklopädie - Klinische Toxikologie - Giftinformation, Giftnachweis, Vergiftungstherapie" Loseblatt-Ausgabe, ecomed-Verlagsgesellschaft mbH, Landsberg

Quelle: 07727
L. Roth "Gefahrstoff-Entsorgung" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag, Landsberg

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

Quelle: 07748
American Conference of Governmental Industrial Hygienists "Documentation of the threshold limit values and biological exposure indices Loseblattsammlung mit Ergänzungslieferungen

Quelle: 07795
H. Geerißen "GloSaDa 2000 Plus - Glove Safety Data"

Quelle: 08097
DFG Deutsche Forschungsgemeinschaft: MAK- und BAT-Werte-Liste 2012, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Mitteilung 48; VCH

Quelle: 99983
Literaturlisten - Standardwerke, erweitert

Quelle: 99996
Projektgebundene Literaturliste Nr. 2

Quelle: 99999
Angabe des Bearbeiters