SAFETY DATA SHEETS

According to Globally Harmonized System of Classification and Labelling of Chemicals (GHS) - Sixth revised edition

Version: 1.0

Creation Date: Aug 10, 2017

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1.Identification

1.1GHS Product identifier

Product name	maleic anhydride

1.2Other means of identification

Product number	-
Other names	Toxilic anhydride

1.3Recommended use of the chemical and restrictions on use

Identified uses	For industry use only. Maleic anhydride is used primarily in the formation of unsaturated polyester resins for use in boats, autos, trucks, buildings, piping, and electrical goods. Lube oil adhesives synthesized from maleic anhydride are used to prolong oil-change intervals and improve engine efficiency. Maleic anhydride is also used to make copolymers, pesticides, and other organic compounds, and in Diels-Alder syntheses.
Uses advised against	no data available

2.Hazard identification

2.1Classification of the substance or mixture

Acute toxicity - Oral, Category 4

Skin corrosion, Category 1B

Skin sensitization, Category 1

Respiratory sensitization, Category 1

2.2GHS label elements, including precautionary statements

Pictogram(s)	
Signal word	Danger
Hazard statement(s)	H302 Harmful if swallowed H314 Causes severe skin burns and eye damage H317 May cause an allergic skin reaction H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled
Precautionary statement(s)	
Prevention	P264 Wash ... thoroughly after handling. P270 Do not eat, drink or smoke when using this product. P260 Do not breathe dust/fume/gas/mist/vapours/spray. P280 Wear protective gloves/protective clothing/eye protection/face protection. P261 Avoid breathing dust/fume/gas/mist/vapours/spray. P272 Contaminated work clothing should not be allowed out of the workplace. P284 [In case of inadequate ventilation] wear respiratory protection.
Response	P301+P312 IF SWALLOWED: Call a POISON CENTER/doctor/…if you feel unwell. P330 Rinse mouth. P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower]. P363 Wash contaminated clothing before reuse. P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing. P310 Immediately call a POISON CENTER/doctor/… P321 Specific treatment (see ... on this label). P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

	Continue rinsing. P302+P352 IF ON SKIN: Wash with plenty of water/... P333+P313 If skin irritation or rash occurs: Get medical advice/attention. P362+P364 Take off contaminated clothing and wash it before reuse. P342+P311 If experiencing respiratory symptoms: Call a POISON CENTER/doctor/...
Storage	P405 Store locked up.
Disposal	P501 Dispose of contents/container to ...

2.3Other hazards which do not result in classification

none

3.Composition/information on ingredients

3.1Substances

Chemical name	Common names and synonyms	CAS number	EC number	Concentration
maleic anhydride	maleic anhydride	108-31-6	none	100%

4.First-aid measures

4.1Description of necessary first-aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

Fresh air, rest. Half-upright position. Refer for medical attention.

In case of skin contact

First rinse with plenty of water for at least 15 minutes, then remove contaminated clothes and rinse again.

In case of eye contact

First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.

If swallowed

Rinse mouth. Give one or two glasses of water to drink. Do NOT induce vomiting. Refer for medical attention .

4.2Most important symptoms/effects, acute and delayed

Inhalation causes coughing, sneezing, throat irritation. Skin contact causes irritation and redness. Vapors cause severe eye irritation; photophobia and double vision may occur. (USCG, 1999)

4.3Indication of immediate medical attention and special treatment needed, if necessary

Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR as necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Organic acids and related compounds/

5.Fire-fighting measures

5.1Extinguishing media

Suitable extinguishing media

Wear self-contained breathing apparatus for firefighting if necessary.

5.2Specific hazards arising from the chemical

Behavior in Fire: When heated above 148.89°C in the presence of various materials may generate heat and carbon dioxide. Will explode if confined. (USCG, 1999)

5.3Special protective actions for fire-fighters

Wear self-contained breathing apparatus for firefighting if necessary.

6.Accidental release measures

6.1Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2Environmental precautions

Personal protection: face shield, thermal gloves, chemical protection suit and particulate filter respirator adapted to the airborne concentration of the substance. See Notes. Sweep spilled substance into covered containers.

6.3Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7.Handling and storage

7.1Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Avoid exposure - obtain special instructions before use.Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2Conditions for safe storage, including any incompatibilities

Dry. Separated from strong oxidants, strong bases and food and feedstuffs.Keep container tightly closed in a dry and well-ventilated place. Moisture sensitive. Storage class (TRGS 510): Non-combustible, corrosive hazardous materials

8.Exposure controls/personal protection

8.1Control parameters

Occupational Exposure limit values

Recommended Exposure Limit: 10 Hr Time-Weighted Avg: 1 mg/cu m (0.25 ppm).

Biological limit values

no data available

8.2Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3Individual protection measures, such as personal protective equipment (PPE)

Eye/face protection

Safety glasses with side-shields conforming to EN166. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Wear impervious clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace. Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique(without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Respiratory protection

Wear dust mask when handling large quantities.

Thermal hazards

no data available

9.Physical and chemical properties

Physical state	White crystals
Colour	Orthorhombic needles from chloroform; commercial grades furnished in fused form, as briquettes
Odour	Pungent odor
Melting point/ freezing point	47°C(lit.)
Boiling point or initial boiling point and boiling range	200°C(lit.)
Flammability	Combustible Solid, but may be difficult to ignite.Combustible.
Lower and upper explosion limit /	Flammable limits: 1.4% by volume (Lower) 7.1% by volume (Upper)

flammability limit	
Flash point	65°C(lit.)
Auto-ignition temperature	465.56°C
Decomposition temperature	no data available
pH	pH of water solutions: 2.42 at 1X10-2 M; 2.62 at 5X10-3 M; 3.10 at 1X10-4 M
Kinematic viscosity	Viscosity in mPa.s (cP): 0.61 at 60°C; 1.07 at 90°C; 0.6 at 150°C
Solubility	In water:79 g/100 mL (25 ºC)
Partition coefficient n-octanol/water (log value)	log Kow = 1.62
Vapour pressure	0.16 mm Hg (20 °C)
Density and/or relative density	1.48
Relative vapour density	3.4 (vs air)
Particle characteristics	no data available

10.Stability and reactivity

10.1Reactivity

no data available

10.2Chemical stability

Stable under normal laboratory storage conditions.

10.3Possibility of hazardous reactions

Great care must be taken with the molten and vapor as material in this state is flammable. The material is a combustible solid... .MALEIC ANHYDRIDE react vigorously on contact with oxidizing materials. Reacts exothermically with water or steam. Undergoes violent exothermic decomposition reactions, producing carbon dioxide, in the presence of strong bases (sodium hydroxide, potassium hydroxide, calcium hydroxide), alkali metals (lithium, sodium, potassium), aliphatic amines (dimethylamine, trimethylamine), aromatic amines (pyridine, quinoline)

at temperatures above 150° C [Vogler, C. A. et al., J. Chem. Eng. Data, 1963, 8, p. 620]. A 0.1% solution of pyridine (or other tertiary amine) in maleic anhydride at 185°C gives an exothermic decomposition with rapid evolution of gas [Chem Eng. News 42(8); 41 1964]. Maleic anhydride is known as an excellent dienophile in the Diels-Alder reaction to produce phthalate ester derivatives. These reactions can be extremely violent, as in the case of 1-methylsilacyclopentadiene [J. Organomet., Chem., 1979, 179, c19]. Maleic anhydride undergoes a potentially explosive exothermic Diels-Alder reaction with 1-methylsilacyclopenta-2,4-diene at 150C [Barton, T. J., J. Organomet. Chem., 1979, 179, C19], and is considered an excellent dieneophile for Diels-Alder reactions [Felthouse, Timothy R. et al. "Maleic Anhydride, Maleic Acid, and Fumaric Acid." Kirk-Othmer Encyclopedia of Chemical Technology. John Wiley & Sons, Inc. 2005].

10.4Conditions to avoid

no data available

10.5Incompatible materials

Incompatible with alkali metals, caustics, and amines at greater than 150 deg F.

10.6Hazardous decomposition products

Maleic anhydride decomposes exothermically, evolving carbon dioxide in the presence of dimethylamine, triethylamine, pyridine, or quinoline at temperatures above 150°C.

11.Toxicological information

Acute toxicity

- Oral: LD50 Guinea pig oral 390 mg/kg
- Inhalation: no data available
- Dermal: no data available

Skin corrosion/irritation

no data available

Serious eye damage/irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

A4; Not classifiable as a human carcinogen.

Reproductive toxicity

No information is available on the reproductive or developmental effects of maleic anhydride in humans. No teratogenic or fetotoxic effects were observed in the offspring of rats exposed via gavage or diet.

STOT-single exposure

no data available

STOT-repeated exposure

no data available

Aspiration hazard

no data available

12.Ecological information

12.1Toxicity

- Toxicity to fish: LC50; Species: Lepomis macrochirus (Bluegill); Conditions: static, aeration by "oxygenation interface method" (contact between pure oxygen and test sample); test organisms acclimated to test temperature for 10-14 days; 20°C, pH 6.9-7.5, dechlorinated water, total hardness 84.0-163.0 mg/L (as CaCO3), 5 mg O2/L or higher; Concentration: 150 mg/L for 24 hr
- Toxicity to daphnia and other aquatic invertebrates: EC50; Species: Daphnia magna (Water flea); Conditions: static, 20°C, pH 8.0; test solution neutralized; Concentration: 5600 mg/L for 24 hr; Effect: immobilization
- Toxicity to algae: EC50; Species: Haematococcus pluvialis (Algae); Concentration: 190 mg/L for 4 hr; Effect: inhibition of oxygen production /Conditions of bioassay not specified in source examined
- Toxicity to microorganisms: no data available

12.2Persistence and degradability

AEROBIC: Maleic anhydride, present at 100 mg/L, reached 54.8% of its theoretical BOD in 2 weeks using an activated sludge inoculum at 30 mg/L and the Japanese MITI test(1). Using OECD Guideline 301B (Ready Biodegradability: CO2 Evolution Test), maleic anhydride was found to be readily biodegradable with CO2 evolution rates of 61.6% after 4 days and 93.2% after 11 days(2); it was noted that maleic anhydride hydrolyzes under the test conditions and, as a result, maleic acid is believed to be the test material investigated in the study(2). Another OECD Guideline 301B test determined >90% CO2 evolution within 25 days(2). Using OECD Guideline 301E (Ready Biodegradability: Modified OECD Screening Test) and a non-adapted activated sludge inoculum, maleic anhydride was found to be readily biodegradable with a 73-81% removal after 28 days(2). The TOC and COD-Mn of maleic anhydride, present at 170 mg/L in industrial wastewater, was reduced by 98% and 99%, respectively, after 1 day of acclimation with an activated sludge inocculum from a waste water treatment plant(3). In one report 99% removal was achieved in 4 hr by activated sludge(4). Others report 40-60% theoretical BOD in 5 days with sewage inoculum(5,6). The data suggest that maleic anhydride is expected to biodegrade rapidly(SRC); however, maleic anhydride hydrolyzes rapidly in water forming maleic acid with hydrolysis half-lives of 3.32 and 0.37 minutes at 0 and 25.1°C, respectively(7). Therefore, the available biodegradation rates are expected to correspond primarily to maleic acid(SRC).

12.3Bioaccumulative potential

An estimated BCF of 5 was calculated in fish for maleic anhydride(SRC), using an estimated log Kow of 1.62(1) and a regression-derived equation(1). According to a classification scheme(2), this BCF suggests the potential for bioconcentration in aquatic organisms is low(SRC). In addition, maleic anhydride hydrolyzes rapidly in water forming maleic acid with hydrolysis half-lives of 3.32 and 0.37 minutes at 0 and 25.1°C respectively(3). Bioconcentration of maleic anhydride in aquatic organisms is unlikely due its rapid hydrolysis(SRC).

12.4Mobility in soil

Using a structure estimation method based on molecular connectivity indices(1), the Koc of maleic anhydride can be estimated to be 1(SRC). According to a classification scheme(2), this estimated Koc value suggests that maleic anhydride is expected to have very high mobility in soil. However, maleic anhydride hydrolyzes rapidly in water forming maleic acid with hydrolysis half-lives of 3.32 and 0.37 minutes at 0 and 25.1°C respectively(3). Therefore, potential leaching in soil is expected to be dominated by degradation to maleic acid(SRC).

12.5Other adverse effects

no data available

13.Disposal considerations

13.1Disposal methods

Product

The material can be disposed of by removal to a licensed chemical destruction plant or by controlled incineration with flue gas scrubbing. Do not contaminate water, foodstuffs, feed or seed by storage or disposal. Do not discharge to sewer systems.

Contaminated packaging

Containers can be triply rinsed (or equivalent) and offered for recycling or reconditioning. Alternatively, the packaging can be punctured to make it unusable for other purposes and then be disposed of in a sanitary landfill. Controlled incineration with flue gas scrubbing is possible for combustible packaging materials.

14.Transport information

14.1UN Number

ADR/RID: UN2215	IMDG: UN2215	IATA: UN2215

14.2UN Proper Shipping Name

ADR/RID: MALEIC ANHYDRIDE
IMDG: MALEIC ANHYDRIDE
IATA: MALEIC ANHYDRIDE

14.3Transport hazard class(es)

ADR/RID: 8	IMDG: 8	IATA: 8

14.4Packing group, if applicable

ADR/RID: III	IMDG: III	IATA: III

14.5Environmental hazards

ADR/RID: no	IMDG: no	IATA: no

14.6Special precautions for user

no data available

14.7Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

no data available

15.Regulatory information

15.1Safety, health and environmental regulations specific for the product in question

Chemical name	Common names and synonyms	CAS number	EC number

maleic anhydride	maleic anhydride	108-31-6	none
European Inventory of Existing Commercial Chemical Substances (EINECS)			Listed.
EC Inventory			Listed.
United States Toxic Substances Control Act (TSCA) Inventory			Listed.
China Catalog of Hazardous chemicals 2015			Listed.
New Zealand Inventory of Chemicals (NZIoC)			Listed.
Philippines Inventory of Chemicals and Chemical Substances (PICCS)			Listed.
Vietnam National Chemical Inventory			Listed.
Chinese Chemical Inventory of Existing Chemical Substances (China IECSC)			Listed.

16.Other information

Information on revision

Creation Date	Aug 10, 2017
Revision Date	Aug 10, 2017

Abbreviations and acronyms

- CAS: Chemical Abstracts Service
- ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
- RID: Regulation concerning the International Carriage of Dangerous Goods by Rail
- IMDG: International Maritime Dangerous Goods
- IATA: International Air Transportation Association
- TWA: Time Weighted Average
- STEL: Short term exposure limit
- LC50: Lethal Concentration 50%
- LD50: Lethal Dose 50%
- EC50: Effective Concentration 50%

References

- IPCS - The International Chemical Safety Cards (ICSC), website: http://www.ilo.org/dyn/icsc/showcard.home
- HSDB - Hazardous Substances Data Bank, website: https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
- IARC - International Agency for Research on Cancer, website: http://www.iarc.fr/

- eChemPortal - The Global Portal to Information on Chemical Substances by OECD, website: http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en
- CAMEO Chemicals, website: http://cameochemicals.noaa.gov/search/simple
- ChemIDplus, website: http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp
- ERG - Emergency Response Guidebook by U.S. Department of Transportation, website: http://www.phmsa.dot.gov/hazmat/library/erg
- Germany GESTIS-database on hazard substance, website: http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp
- ECHA - European Chemicals Agency, website: https://echa.europa.eu/
