SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Maleic acid

Product Number : M0375
Brand : Sigma-Aldrich
Index-No. : 607-095-00-3
CAS-No. : 110-16-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 Spruce Street
ST. LOUIS MO  63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Dermal (Category 4), H312
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Skin sensitisation (Category 1), H317
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Short-term (acute) aquatic hazard (Category 3), H402

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word Danger

Hazard statement(s)
H302 + H312 Harmful if swallowed or in contact with skin.
H314 Causes severe skin burns and eye damage.
H317 May cause an allergic skin reaction.
H335 May cause respiratory irritation.
H402 Harmful to aquatic life.

Precautionary statement(s)
P260 Do not breathe dust or mist.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing must not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. 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/shower.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
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/doctor.
P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.
P363 Wash contaminated clothing before reuse.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms: Toxilic acid, cis-Butenedioic acid

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms</td>
<td>Toxilic acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cis-Butenedioic acid</td>
<td></td>
</tr>
<tr>
<td>Formula</td>
<td>C₄H₄O₄</td>
<td></td>
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<tr>
<td>Molecular weight</td>
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<tr>
<td>Index-No.</td>
<td>607-095-00-3</td>
<td></td>
</tr>
</tbody>
</table>
(Z)-2-Butenedioic acid

| Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; Skin Sens. 1; STOT SE 3; Aquatic Acute 3; H302, H312, H314, H318, H317, H335, H402 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
SECTION 6: Accidental release measures

6.1 Personal 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.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods 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.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): 8A: Combustible, corrosive hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
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.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance
Form: powder
Colour: white

b) Odour
slightly sourish
c) Odour Threshold  
No data available

d) pH  
1.3 at 100 g/l at 20 °C (68 °F)

e) Melting point/freezing point  
Melting point: 130 - 135 °C (266 - 275 °F)

f) Initial boiling point and boiling range  
157.8 °C 316.0 °F at 997 hPa - OECD Test Guideline 103

g) Flash point  
No data available

h) Evaporation rate  
No data available

i) Flammability (solid, gas)  
No data available

j) Upper/lower flammability or explosive limits  
No data available

k) Vapour pressure  
< 0.1 hPa at 20 °C (68 °F) - OECD Test Guideline 104

l) Vapour density  
4.0 at 20 °C(68 °F)

m) Relative density  
1.59 g/cm3 at 25 °C (77 °F) - lit.

n) Water solubility  
478.8 g/l at 20 °C (68 °F) - OECD Test Guideline 105 - completely soluble

o) Partition coefficient: n-octanol/water  
log Pow: -1.3 at 20 °C (68 °F) - OECD Test Guideline 107 - Bioaccumulation is not expected.

p) Auto-ignition temperature  
No data available

q) Decomposition temperature  
> 135 °C (> 275 °F) -

r) Viscosity  
No data available

s) Explosive properties  
No data available

t) Oxidizing properties  
No data available

9.2 Other safety information

Minimum ignition energy  
> 30 - < 100 mJ

Bulk density  
750 - 800 kg/m3

Relative vapour density  
4.0 at 20 °C (68 °F)

SECTION 10: Stability and reactivity

10.1 Reactivity  
No data available

10.2 Chemical stability  
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions  
No data available
10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - 1,090 mg/kg
(OECD Test Guideline 401)
Remarks: (in analogy to similar compounds)
Inhalation: No data available
Inhalation: Irritating to respiratory system.
Dermal: No data available
No data available

Skin corrosion/irritation
Skin - In vitro study
Result: Causes burns.
(OECD Test Guideline 435)

Serious eye damage/eye irritation
Causes serious eye damage. (Regulation (EC) No 1272/2008, Annex VI)

Respiratory or skin sensitisation
Maximisation Test - Guinea pig
Result: positive
(OECD Test Guideline 406)
Local lymph node assay (LLNA) - Mouse
Result: positive
(OECD Test Guideline 429)
(Regulation (EC) No 1272/2008, Annex VI)

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
May cause respiratory irritation. - Respiratory system
Acute oral toxicity - Vomiting, Irritations of mucous membranes in the mouth, pharynx, oesophagus and gastrointestinal tract.
Acute inhalation toxicity - mucosal irritations, Cough, Shortness of breath, Possible damages:, damage of respiratory tract, Lung oedema, Symptoms may be delayed.

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**
RTECS: Not available

Gastrointestinal disturbance
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Systemic effects:
After absorption:
Allergic reactions, Cough, Irritations, Shortness of breath, Vomiting, Lung oedema
Possible effects:
Damage to:, respiratory tract
Other dangerous properties can not be excluded.
Handle in accordance with good industrial hygiene and safety practice.

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### SECTION 12: Ecological information

#### 12.1 Toxicity

- **Toxicity to daphnia and other aquatic invertebrates** static test EC50 - Daphnia magna (Water flea) - 42.81 mg/l - 48 h (OECD Test Guideline 202)
- **Toxicity to algae** static test ErC50 - Pseudokirchneriella subcapitata (green algae) - 74.35 mg/l - 72 h (OECD Test Guideline 201)
- **Toxicity to bacteria** static test EC10 - Pseudomonas putida - 44.6 mg/l - 18 h (DIN 38 412 Part 8)

**Remarks:** (in analogy to similar products)

#### 12.2 Persistence and degradability

- **Biodegradability** aerobic - Exposure time 28 d
  Result: 97.08 % - Readily biodegradable.
  (OECD Test Guideline 301B)
- **Theoretical oxygen demand** 830 mg/g
- **Ratio BOD/ThBOD** 77 %

**Remarks:** (Lit.)

#### 12.3 Bioaccumulative potential
No data available

#### 12.4 Mobility in soil
No data available
12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Contact a licensed professional waste disposal service to dispose of this material. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

DOT (US)
UN number: 3261  Class: 8  Packing group: II
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. ((Z)-2-Butenedioic acid)
Reportable Quantity (RQ): 5000 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3261  Class: 8  Packing group: II  EMS-No: F-A, S-B
Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. ((Z)-2-Butenedioic acid)

IATA
UN number: 3261  Class: 8  Packing group: II
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. ((Z)-2-Butenedioic acid)

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.
SECTION 16: Other information

Further information
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