Section 1 - Product and Company Information

Product Name                  MALEIC ACID
Product Number                63180
Brand                         FLUKA
Company                       Sigma-Aldrich
Address                       3050 Spruce Street
                              SAINT LOUIS MO 63103 US
Technical Phone:              800-325-5832
Fax:                          800-325-5052
Emergency Phone:             314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name                MALEIC ACID REAGENTPLUS® >=99%
CAS #                        110-16-7
SARA 313                     No

Formula          C4H4O4
Synonyms          Butenedioic acid, (Z)- * cis-Butenedioic acid *
cis-1,2-Ethylenedicarboxylic acid *
1,2-Ethylenedicarboxylic acid, (Z) * Kyselina
maleinova (Czech) * Maleinic acid * Malenic acid
 * Toxilic acid
RTECS Number: OM96250000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Harmful.
Harmful in contact with skin and if swallowed. Risk of serious
damage to eyes. Irritating to respiratory system and skin.

HMIS RATING
HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is
conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give
artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

EXPLOSION DATA
Dust Potential: This material, like most materials in powder form, is capable of creating a dust explosion.

FLASH POINT
212 °F  100 °C  Method: closed cup

EXPLOSION LIMITS
Lower: 2.7 %

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe dust. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.
Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a dust mask type N95 (US) or type P1 (EN 143) respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>At Temperature or Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Physical State: Solid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Color: White</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Form: Powder</td>
<td></td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>116.07 AMU</td>
<td></td>
</tr>
<tr>
<td>pH</td>
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<td></td>
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<tr>
<td>BP/BP Range</td>
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<tr>
<td>MP/MP Range</td>
<td>137 °C</td>
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<tr>
<td>Freezing Point</td>
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<tr>
<td>Vapor Pressure</td>
<td>4 mmHg</td>
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<tr>
<td>Vapor Density</td>
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<tr>
<td>Saturated Vapor Conc.</td>
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<tr>
<td>SG/Density</td>
<td>1.59 g/cm³</td>
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<tr>
<td>Bulk Density</td>
<td>750.0 - 800.0 kg/l</td>
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<tr>
<td>Odor Threshold</td>
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<tr>
<td>Volatile%</td>
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<tr>
<td>VOC Content</td>
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<tr>
<td>Water Content</td>
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<tr>
<td>Solvent Content</td>
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<tr>
<td>Evaporation Rate</td>
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<tr>
<td>Viscosity</td>
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<tr>
<td>Surface Tension</td>
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<tr>
<td>Partition Coefficient</td>
<td>Log Kow: - 0.480</td>
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<tr>
<td>Decomposition Temp.</td>
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<tr>
<td>Flash Point</td>
<td>212 °F 100 °C</td>
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<tr>
<td>Explosion Limits</td>
<td>Lower: 2.7 %</td>
<td></td>
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<tr>
<td>Flammability</td>
<td>N/A</td>
<td></td>
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<tr>
<td>Autoignition Temp</td>
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<tr>
<td>Refractive Index</td>
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<td>Optical Rotation</td>
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<td>Miscellaneous Data</td>
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<tr>
<td>Solubility</td>
<td>Solubility in Water: soluble</td>
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<td></td>
<td>Other Solvents: ALCOHOL, GLACIAL ACETIC ACID ACETONE</td>
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</tbody>
</table>

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: Causes skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: Causes eye irritation.
Inhalation: Material is irritating to mucous membranes and upper respiratory tract. May be harmful if inhaled.
Ingestion: Harmful if swallowed.

SIGNS AND SYMPTOMS OF EXPOSURE
Exposure can cause: Gastrointestinal disturbances.

TOXICITY DATA

Oral
Rat
708 mg/kg
LD50
Remarks: Behavioral: Convulsions or effect on seizure threshold.
Behavioral: Muscle weakness. Gastrointestinal: Ulceration or bleeding from stomach.

Inhalation
Rat
> 720 mg/m3
LC50

Oral
Mouse
2400 mg/kg
LD50
Remarks: Tumorigenic: Active as anti-cancer agent.

Skin
Rabbit
1560 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit
500 mg
24H
Remarks: Mild irritation effect

Eyes
Rabbit
100 mg
Remarks: Severe irritation effect

Eyes
Rabbit
1 %
2M
Remarks: Severe irritation effect

CHRONIC EXPOSURE - MUTAGEN

Species: Human
Dose: 20 MMOL/L
Cell Type: fibroblast
Mutation test: DNA inhibition

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 48 h
Value: 160.0 - 400.0 mg/l

Test Type: EC100 Daphnia
Species: Daphnia magna
Time: 24 h
Value: 200 mg/l

Test Type: LC50 Fish
Species: Pimephales promelas (Fathead minnow)
Time: 96 h
Value: 5 mg/l

Test Type: LC50 Fish
Species: Leuciscus idus
Value: 106 mg/l

Test Type: LC0 Fish
Species: Lepomis macrochirrus (Bluegill)
Time: 96 h
Value: > 300 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: None
Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA
Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information
EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn
Indication of Danger: Harmful.
R: 22-36/37/38
Risk Statements: Harmful if swallowed. Irritating to eyes, respiratory system and skin.
S: 26-28-37
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap-suds. Wear suitable gloves.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Harmful.
Risk Statements: Harmful in contact with skin and if swallowed. Risk of serious damage to eyes. Irritating to respiratory system and skin.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Take off immediately all contaminated clothing. Wear suitable protective clothing, gloves, and eye/face protection. Keep container tightly closed in a cool place.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: No
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2009 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.