# Product Stewardship Summary

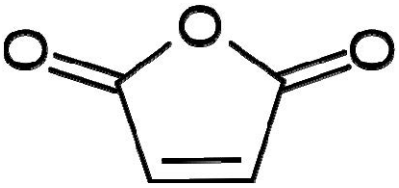
## *Maleic anhydride*

### General Statement

Maleic anhydride (MAN) is an organic chemical intermediate for the manufacture of numerous products including unsaturated polyester resins (UPR), MAN-based copolymers, lube oil additives, alkyl succinic anhydrides (ASA), malic acid, fumaric acid and various agricultural chemicals. UPR's are used in boats, automobiles, buildings, piping, and electrical goods. MAN-based copolymers consist of a wide variety of copolymers with diverse applications including compatibilizers and coupling agents with polyolefins and as thickeners, dispersants and stabilizing agents in consumer products such as cosmetics and toiletries. Lube oil additives synthesized from maleic anhydride are used to prolong oil change intervals and improve engine efficiency. ASA's are used in a variety of applications including paper sizing, detergents, leather treatment and food products. Malic acid is primarily used as an additive to food and beverages to control pH and enhance flavors. Fumaric acid uses include paper sizing, food acidulant and UPR manufacture. Agricultural chemicals from maleic anhydride include pesticides, herbicides and growth regulators.
Maleic anhydride rapidly forms maleic acid when in contact with water. This acid is an irritant and skin sensitizer. Consumer exposure to maleic anhydride is uncommon, and worker exposure is controlled by protective equipment and ventilation.

### Chemical Identity

Name: Maleic Anhydride
Brand Names: Sold as such, and incorporated into unsaturated polyester resins and food additive products
Chemical name (IUPAC): furan-2,5-dione
CAS number(s): 108-31-6
EC number: 203-571-6
Molecular formula: $C_4H_2O_3$
Structure:



### Uses and Applications

Ashland produces maleic anhydride in the USA. Ashland uses maleic anhydride to produce unsaturated polyester resins and food additive products. Ashland also sells maleic anhydride into a variety of applications, such as food modification, lubricating oils, cosmetics, toiletries, detergents, pesticides, and herbicides.



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## Physical/Chemical Properties

### Phys/Chem Safety Assessment

| Property | Value |
|---|---|
| Form | Colorless needles, white lumps, pellets |
| Physical state | Solid |
| Color | Colorless to white |
| Odor | Irritating, choking |
| Density | 1.43 g/cm$^3$@ 20°C |
| Melting / boiling point | 53.58°C / 200.1°C |
| Flammability | Not classified |
| Explosive properties | Not classified |
| Self-ignition temperature | N/A |
| Vapor pressure | 0.33 hPa @ |
| Mol weight | 98.06 g/mol |
| Water solubility | ~400 g/L @ 20°C |
| Flash point | N/A |
| Octanol-water partition coefficient (Log$k_{ow}$) | -2.78 @ pH 7 |

## Exposure, Hazard and Safety Assessment

The following section describes possible exposures scenarios and hazards associated with maleic anhydride. The exposure assessment describes both the amount of and the frequency with which a chemical substance reaches a person, a population of people, or the environment. Hazard refers to the inherent properties of a substance that make it capable of causing harm to human health or the environment. The safety assessment reports the possibility of a harmful event arising from exposure to a chemical or physical agent under specific conditions. Just because a substance may possess potentially harmful properties does not mean that it automatically poses a risk. It is not possible to make that determination without understanding the exposure.

## Human Health Effects

### Human Exposure Assessment

**Consumer:** Consumer exposure to maleic anhydride is expected to be minimal. Free Maleic anhydride is not released from consumer products.

**Worker:** Some exposure may be possible around manufacturing sites which make or use maleic anhydride.

**Human Hazard Assessment**

| Effect Assessment | Result |
|---|---|
| Acute Toxicity<br>Oral / inhalation / dermal | H302: Harmful if swallowed. |
| Irritation / corrosion<br>Skin / eye / respiratory test | Causes severe skin burns and eye damage. |
| Sensitization | H317: May causes an allergic skin reaction.<br>H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled. |
| Toxicity after repeated exposure<br>Oral / inhalation / dermal | Prolonged or repeated exposure does not cause any harmful effects |
| Genotoxicity / Mutagenicity | Does not affect genetic system |
| Carcinogenicity | Not considered as a carcinogen |
| Reproductive / Developmental Toxicity | Not toxic to reproduction or to unborn children |
| Aspiration hazard | Not applicable |

**Human Health Safety Assessment**

**Consumer:** Consumer exposure to maleic anhydride is unlikely. Consumer products are unlikely to contain significant concentrations of maleic anhydride.

**Worker:** Maleic anhydride reacts with water to form maleic acid. This acid is corrosive, and will cause burns on contact. As a result, maleic anhydride contact with dry skin will cause a delayed burning sensation, while contact with wet or sweaty skin will cause an immediate burning sensation. Inhalation of maleic vapor may cause damage to throat, larynx, and lungs. Eye exposure will cause burning, and sensitivity to bright light. Eye damage is possible from exposure to both maleic anhydride powder and vapors. Extended exposure to maleic anhydride can cause skin sensitization, upper respiratory lesions, and shortness of breath.

## Environmental Effects

**Environmental Exposures**

Worker exposure to maleic anhydride can occur with powdered, molten, or vaporous maleic anhydride. Exposure to molten maleic anhydride poses dangers due to high temperatures.

**Environmental Hazard Assessment:**

| Effect Assessment | Result |
|---|---|
| Aquatic toxicity | Not toxic to aquatic organisms |

| Fate and behavior | Result |
|---|---|
| Biodegradation | Readily biodegradable |
| Bioaccumulation potential | Unlikely to bioaccumulate. |
| PBT / vPvB conclusion | This substance is not considered to be persistent, bioaccumulating and toxic (PBT) or very persistent and very bioaccumulating (vPvB) |

**Environmental Safety Assessment**

Maleic anhydride will inhibit growth of some species of aquatic algae at a concentration of 29 mg/L, but animal effects begin at about 3x that concentration. While some acute toxicity is expected due to the acidity of maleic acid, long-term toxicity is expected to be minimal. Overall, the acidity of maleic acid poses the greatest hazard for maleic anhydride exposure.

## Risk Management Recommendations

Workers who may be exposed to concentrations of maleic anhydride above the PEL but below the ILDH should be protected by a positive-pressure respirator. Emergency escape may be accomplished with the aid of an air-purifying, full-facepiece respirator (gas mask) with an organic vapor canister having an N100, R100, or P100 filter. Skin contact with maleic anhydride should be treated immediately by washing with soap and water. In case of eye contact, or eye irritation from vapor, irrigate eyes immediately with lukewarm water or saline solution. If ingested, seek medical attention immediately. Do not attempt to induce vomiting. Do not attempt to neutralize the acid due to heat-producing reactions. Administer 1 cup of water or milk to adults while seeking medical attention. If difficulty breathing is noted, evacuate to fresh air and seek immediate medical attention.
US OSHA PEL: 1 mg/m3 (8h TWA)
ACGIH TLV: 0.01 mg/m3 (8h TWA)
EU and member states: http://osha.europa.eu/en/topics/ds/oel/index.stm/members.stm
China: 1 mg/m3 (8h TWA)

## Regulatory Agency Review

Maleic anhydride:

- is on the list of REACH registered substances (EC) 1907/2006
- is on the US TSCA inventory
- is listed on Canada's DSL list
- is on the Australia Index of Chemical Substances
- is on the China Inventory of Existing Chemical Substances
- is on the Japan Inventory of Existing and New Chemical Substances
- is on the Korea Existing Chemicals Inventory
- is on the New Zealand Inventory of Chemicals
- is on the Philippines Inventory of Chemicals and Chemical Substances

## Regulatory Information / Classification and Labeling

Under the Globally Harmonized System for classification and labeling (GHS), substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the (Extended) SDS. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

**GHS Classification:**

Acute toxicity (oral): Category 4
Skin corrosion/irritation: Category 1B
Serious eye damage/eye irritation: Category 1
Respiratory sensitization: Category 1
Skin sensitization: Category 1A
Specific target organ toxicity (repeated exposure): Category 1 (inhalation – respiratory system)
Aquatic acute toxicity: Category 3

**Hazard Statements:**

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

**Signal Word:**

Danger

**Precautionary Statements:**

P280: Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P330 + P331: IF SWALLOWED: rinse mouth. DO NOT induce vomiting.
P303+P361+P353: IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308: IF exposed or concerned
P310: Immediately call a POISON CENTER or doctor/ physician.

**Hazard Pictograms:**

## Conclusion

Maleic anhydride is a reactive chemical used is the manufacture of a number of useful chemicals and products. When properly contained and safely handled, maleic anhydride presents a low risk to workers or consumers.

## Contact Information with Company

Ashland LLC
5200 Blazer Parkway
Dublin, Ohio 43017
http://www.ashland.com/contact

**Date of Issue:** December 15, 2018
**Revision:** 2

## Additional Information

For more information on GHS, visit http://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf or http://live.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html.
Ashland product stewardship summaries are located at http://www.ashland.com/sustainability/product/product-stewardship

## Disclaimer

*All statements, information and data presented herein are believed to be accurate and reliable, but are not to be taken as a guarantee, an express warranty, or an implied warranty of merchantability or fitness for a particular purpose, or representation, express or implied, for which Ashland and its subsidiaries assume legal responsibility.*

*REACH registration is specific to Importers/Manufacturers that place the chemical on the EU market, and is specific to registered uses. Inclusion on the list of REACH Registered Substances does not automatically imply registration by Ashland.*

*Inclusion on the New Zealand Inventory of Chemicals applies only to the pure substance listed. The importer of record must determine whether or not their substances are in compliance.*