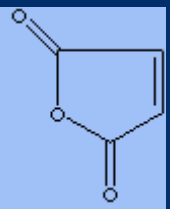
MALEIC ANHYDRIDE

PRODUCT IDENTIFICATION



CAS NO.	108-31-6
EINECS NO.	203-571-6
FORMULA	$C_4H_2O_3$
MOL WT.	98.06
H.S. CODE	2917.14
TOXICITY	
SYNONYMS	cis-Butenedioic acid anhydride; Toxilic anhydride; 2,5-dihydro-2,5-dioxofuran; 2,5-furandione; 2,5-Furanedione; Maleic Acid Anhydride; Maleic anhydride;
DERIVATION CLASSIFICATION	CARBOXYLIC ACID ANHYDRIDES /

GENERAL DESCRIPTION

Maleic Anhydride is the anhydride of cis-butenedioic acid (maleic acid) which carboxylic acid groups are next to each other in the cis form. Maleic Anhydride has a cyclic structure with a ring containing four carbon atoms and one oxygen atom. It is soluble in acetone, hydrolyzing in water. It is prepared in commerce by the oxidation of benzene with catalyst at high temperatures or by the reaction of C4 (butane) with oxygen in the presence of vanadium catalyst. It is used in 1,4-cyclo polyaddition and polycondensation as a dienophile. Maleic Anhydride's biggest single use is in the manufacture of unsaturated polyester resins for use in fibre-reinforced plastics in the automotive, construction, marine, consumer goods and agricultural industries. Producers are working at capacity, but maleic supplies are barely adequate for market requirements due to planned and unplanned downtime in recent days and continued strong demand.

Maleic Anhydride has attractive molecule structure in chemistry. Its reactivity of the two carbonyl groups and the double bond in conjugation with the two carbonyl oxygens provide broad applications in commerce. Examples of reactions which maleic anhydride are :

- Acylation
- Alkylation
- Amidation
- Cycloaddition
- Decomposition and Decarboxylation
- Diels-Alder reaction
- Electrophilic Addition and Nucleophilic Addition
- Ene Reaction
- Esterification
- Formation of Acid Chloride
- Grignard Reactions
- Halogenation
- Heterogeneous catalytic reduction
- Hydration and Dehydration
- Hydroformylation

- Isomerization
- Ligation
- Michael Addition
- Ozonolysis and Oxidaton
- Polymerization

PHYSICAL AND CHEMICAL PROPERTIES	
PHYSICAL STATE	White crystals
MELTING POINT	51 - 53 C
BOILING POINT	202 C (Decomposes)
SPECIFIC GRAVITY	1.48
SOLUBILITY IN WATER	hydrolysis
pH	
VAPOR DENSITY	3.4
AUTOIGNITION	477 C
NFPA RATINGS	Health: 3; Flammability: 1; Reactivity: 1
REFRACTIVE INDEX	
FLASH POINT	103 C
STABILITY	Stable under ordinary conditions.

APPLICATIONS
Unsaturated polyester resins, lubricating oil additives, copolymers, fumaric acid, agricultural chemicals, malic acid, sulfosuccinic acid esters, alkenyl succinic anhydrides and alkyd resins.

SALES SPECIFICATION	
APPEARANCE	White crystals
PURITY	99.5% min
SOLIDFICATION POINT	52.40 C min
MOLTEN COLOR	25 max APHA

TRANSPORTATION	
PACKING	25kgs in bag
HAZARD CLASS	8 (Packing Group: III)
UN NO.	2215

OTHER INFORMATION
Hazard Symbols: C, Risk Phrases: 22-34-42/43, Safety Phrases: 22-26-36/37/39-45

GENERAL DESCRIPTION OF ANHYDRIDE
Anhydride is a compound formed by the abstraction of a molecule of water, H_2O, from a substance. The term acid anhydride is restricted sometime to the anhydride formed especially from an acid by dehydration or one that revert to the original substance upon hydration. In case of bimolecular, it can be composed of two molecules of the corresponding acid. The term mixed anhydride is an acid anhydride composed of two different acids. Examples are adenosine triphosphate or an aminoacyl adenylate. The anhydrides of bases are oxides. Anhydrides of inorganic acids are usually oxides of nonmetallic elements. Carbon dioxide (CO_2) is the anhydride of carbonic acid, dinitrogen pentoxide (N_2O_5) is the anhydride of nitric acid, sodium oxide is an anhydride of sodium hydroxide, phosphorus pentoxide (P_2O_5) is the anhydride of phosphoric acid, and sulfur trioxide (SO_3) is the anhydride of sulfuric acid. An acid anhydride forms an acid; a base anhydride forms a base. Sulfur trioxide (acid anhydride) reacts with water to form sulfuric acid (an acid product). Calcium oxide (an base anhydride) reacts with

water to form calcium hydroxide (a base product).

Organic anhydrides contain the carbonyl group (CO). Organic anhydrides are formed by the condensation of original acids. Lactone, an internal cyclic monoester, is an anhydride derived from the hydroxyl and carboxyl radicals. In organic chemistry, most anhydride compounds are derived from corresponding carboxylic acids. Carboxylic anhydrides, general formula $(RCO)_2O$, are the dehydration product of two carboxylic acid molecules. The name of carboxylic anhydride is given first from the original acid, followed by the separate word "anhydride". $[CH_3(CH_2)_2CO]_2O$ is butanoic anhydride, $CH_3COOCOCH_2CH_3$ is ethanoic propanoic anhydride (or acetic propionic anhydride). Anhydrides are more reactive than the parent acids. Anhydrides are typically not target molecules, but rather they are used as intermediates for the synthesis of other organic members such as esters and amides for the industrial applications include dyes, pharmaceuticals, pesticides, plastics, fibers, curing agents, plasticizers and many others. The reactivity of carboxylic acid derivatives are in order of acyl halides > anhydrides >> esters ¡Ö acids >> amides. Anhydrides react with alcohols to form esters; acetic anhydride $[(CH_3CO)_2O]$ reacts with ethanol (C_2H_5OH) to form ethyl acetate ($CH_3COOC_2H_5$) used as a common solvent. Anhydrides also react with ammonia and primary or secondary amines to form amides. Anhydrides react with water to form their corresponding acids.