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Marine *Newslink*

JANUARY 2022

FEATURE ARTICLE

Maleic Anhydride

PHOTO(S) OF THE MONTH

Uses of MA in Photos

BACK-TO-BASICS

Question of the month

Maleic Anhydride, C4H2O3, also known as Furandione is a workhorse chemical used in the making of many products that are part of our daily lives—among them paper, lacquer, cookware, pharmaceuticals, polyester and agricultural chemicals. Maleic anhydride is a highly toxic substance of the 2nd hazard class, requires special storage and transportation conditions. Normally Maleic Anhydride is colourless or white solid with rhombic crystal structure with an acrid odour.

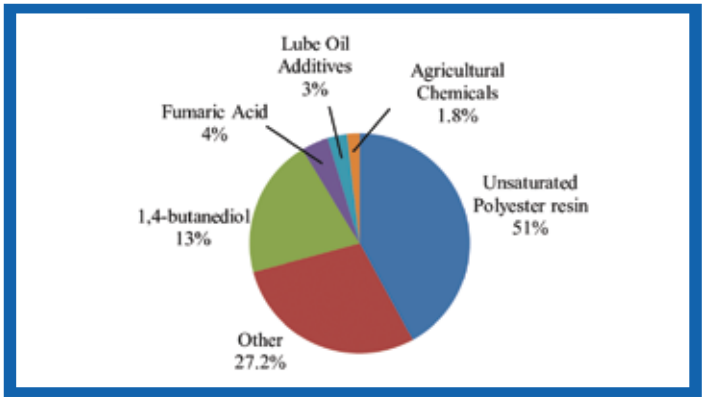
Long-term storage leads to a gradual change in chemical behaviour of raw material and formation of fusible impurities. Typical warranty shelf life is 6 months from the date of production.

Application of Maleic Anhydride

Maleic Anhydride is widely used in chemical industry, mainly in polymerization processes producing high-demand polymer compounds. Approximately 50-55% of world Maleic Anhydride output is used in production of unsaturated polyester resins, which are basic for the manufacturing of fiberglass and other polymeric construction materials.

Maleic Anhydride is used for the manufacture of compositions, which form a strong and plastic polymer film once they are applied to various surfaces. The technology is commonly implemented in protective coating of building sites. Maleic anhydride is used as a plasticizer in concrete, providing better viscosity and pot life.

Polymerization reactions with maleic anhydride are used for production of fibres and various additives for modification of coatings, providing increase of hardness lifetime.



Maleic anhydride is used in following synthetic processes:

- synthesis of fumaric, malic, succinic, maleic acids;
- maleic acid hydrazide (plant growth regulator);
- defoliants (e.g., endotal);
- fungicides (canton, etc.);
- insecticides (kalbofos);
- production of polyester and alkyd resins for construction industry;
- as an additive to lubricating oils to reduce friction;
- as a feedstock in the production of tetrahydrophthalic anhydride, THF and butyrolactone;
- manufacturing of paints, varnishes and lacquers to obtain water-soluble polymers;
- in artificial sweeteners and flavor enhancements;
- for paper sizing agents, water treatment detergents, hair sprays and pharmaceuticals.

There are two main methods for industrial synthesis of maleic anhydride:

- Vapor-phase catalytic oxidation of

benzene by air oxygen over a vanadium-molybdenum oxide catalyst in fixed bed reactors.

- Vapor-phase oxidation of n-Butane over a vanadium-phosphorus oxide catalyst t in fixed and fluidized bed reactors.

Maleic Anhydride can be produced from either n-butane or benzene. The butane process is the newer route and is more economical in most parts of the world as well as more environmentally friendly. In the United States, the benzene process has been phased out since the 1990s. In Europe, benzene-based processes account for less than 15% of total capacity and some facilities operate only sporadically. Historically, benzene derived from coal has been a cost-effective source of feedstock in China, but this situation is changing because of greater supplies of butane on the global market. The benzene process used to dominate with over 85% of the total capacity before 2013, but the butane process has been preferred for most new installations during 2013–18 and now accounts for over 60% of the total. To produce 1 ton of maleic aldehyde 1.11 tons of benzene or 1 ton of n-butane are required, while benzene is almost 1.5 times more expensive than n-butane.

In most regions, consumption closely parallels production. Exports are usually much less than 20% of production. Generally, trade in Maleic Anhydride remains regional because of high transportation costs, especially given the need to heat liquid form in transit.

Maleic Anhydride is typically shipped in a molten state. It has a boiling point of 395 degrees F (202 degrees C); conversely, it will freeze or harden at 127 degrees F (53 degrees C). Maleic Anhydride dissolves in water to form maleic acid. It is stable under normal temperatures and pressures. Conditions to avoid include ignition sources, dust generation, metals, and exposure to moist air and water.

Molten maleic anhydride is generally shipped by land transportation only, while exporters have to install the solidifying facility with extra cost for briquette, pastille, flake, or powder form in oceangoing container shipments. However customised ISO tanks, with heating facility, are becoming available for ocean transits.

HANDLING & STORAGE

Maleic anhydride is corrosive to most metals including bronze, brass, carbon and milled steel, so great care should be taken to avoid contact with these materials. However, aluminium and stainless steel have little to

no effect when exposed to this chemical.

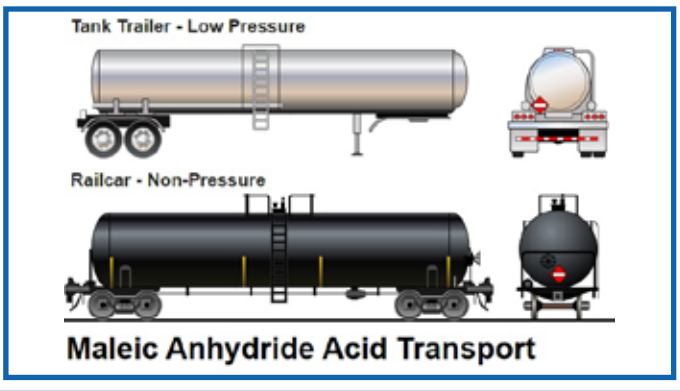
- Maleic Anhydride reacts violently with Strong Bases (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and contact with Oxidizing Agents (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) may cause fires and explosions.
- Maleic Anhydride reacts with WATER to release HEAT and Maleic Acid.
- Maleic Anhydride is not compatible with Alkali Metals (such as LITHIUM, SODIUM and POTASSIUM), Alkaline Earth Metals (such as BERYLLIUM, MAGNESIUM and CALCIUM), AMINES, CARBONATES, HYDROXIDES, and AQUEOUS AMMONIA.
- Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE and METALS.
- Sources of ignition, such as smoking and open flames, are prohibited where Maleic Anhydride is used, handled, or stored in a manner that could create a potential fire or explosion hazard.
- Use only non-sparking tools and equipment, especially when opening and closing containers of Maleic Anhydride.

PACKAGING

Dry Maleic Anhydride can be packed in PPE bags but lined paper bags are also acceptable. In dry form Maleic Anhydride, can be crystal, pellets, or even powder form. Usually packed in 25 kg bag but even 1-ton bags are being accepted. The 25 kg bags are palletised, shrink wrapped & can be double stacked in general container or truck.

TRANSPORTATION

Liquid maleic anhydride can be shipped in road tankers and/or tank-containers which are made of insulated stainless steel and provided with heating systems to maintain the temperature of 65-75 °C. Tank wagons must be approved for the transport of molten maleic anhydride. Liquid/molten maleic anhydride is a dangerous material.



Liquid form is now transported by insulated ISO tanks also. The Maleic Anhydride is manufactured and then heated to liquid form and loaded into insulated ISO tanks, for the ocean transit. During transit, the Maleic Anhydride congeals into a white, wax-like form and must be heated back to a liquid state upon its arrival. As Maleic Anhydride solidifies at room temperature, it must be carefully heated for the loading and unloading of the tanks. Maintaining temperature is important. Allowing it to cool too much or be heated too much can result in the loss of quality & hence the entire tankful.

The Maleic Anhydride has to be heated in stages to prevent it from building up moisture. The heating process also poses the potential risk of altering the substance's colour. One use of Maleic Anhydride is as a bonding agent for products like premium cookware, where a snow-white colour is very important. Overheating it can result on turning its hue to amber which will result in change of cargo specification. The material is also corrosive, which creates handling challenges. Maleic Anhydride viscous nature requires the use of steam pressure to get it to flow efficiently. Advanced heating and removal techniques, including an extraction method by tilting the ISO tank, reduces waste and increases the volume retrieved per load.

Solid maleic anhydride pellets are transported by trucks or containers. Packaging is generally in 25 kg polyethylene bags.

As it reacts easily with steel, if wetted and turn in acid – such scenario may cause mild to severe damages to carrying container. Closed container may explode in uncontrolled condition.

FIRE HAZARDS

In a fire or if heated, the container pressure will increase, and the container may burst. Toxic and irritating gases/fumes may be given off during burning or thermal decomposition.

- Maleic Anhydride is a combustible solid
- Poisonous gases are produced in fire
- Containers may explode in fire
- Dry Chemical or solid stream of water should not be used
- CO2 or water spray or alcohol-resistant forma is best fire extinguishing medium.
- Water spray is also used to cool the fire-exposed containers
- Water runoff from firefighting may be corrosive.

CONTAMINATION HAZARD

- Maleic Anhydride reacts corrosively with most metals & can also react violently with many base chemicals. Wrong combination of mixture of cargoes with Maleic Anhydride can also cause explosion in enclosed container/space

TEMPERATURE HAZARD

- Liquid Maleic Anhydride requires strict temperature control during transportation, but the requisite temperatures are way below freshwater boiling point. General requisite range is 60º-65ºC

HUMIDITY & WATER HAZARD

- Indirect use of water is acceptable but direct contact causes Maleic Anhydride to turn in very corrosive Maleic Anhydride Acid.

WASTE DISPOSAL

The generation of waste should be avoided or minimized wherever possible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Waste disposal should be in accordance with existing federal state, provincial and or local environmental controls laws.

PHOTOS OF THE MONTH

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BACK-TO-BASICS

QUESTION OF THE MONTH

Insured exported a Capex consignment to his European buyer on CIF terms. Insured had taken Sales Turnover policy (STOP) on Institute Cargo Clause (ICC-A) and War & risk basis. The Consignment was not very large & hence was booked in container on LCL (less-Container Load) basis. Without the Insured's knowledge, his cargo was shipped along with non-compatible cargo in the container. At transhipment port, leaks were observed from container & the container was destuffed and the Insured's cargo was restuffed in a new container, by the shipping line. The new container was shipped to destination & but neither the Insured nor his European buyer were aware of the change. After waiting for weeks, the Buyer checked with Insured about whereabouts of his order. Upon checking, the Insured found out about the change of container. It was also found that the new container, with Insured's cargo had reached destination on time but since no one came to claim the cargo, the container had been put in detention. Shipping line alleged that they informed CHA, who in turn failed to inform cargo owners but could provide any proof of such communication and cited Covid situation for miscommunication. Meanwhile shipping line also levied demurrage charges on occupancy of container as per their standard terms and conditions. The Buyer agreed to accept the cargo but asked Insured to bear all the additional charges. Unable to convince the shipping line to withdraw the demurrage charges, since they failed to show proof of communication with CHA, Insured wants to claim these additional charges under his STOP policy.

Q: Are these charges payable under the policy & conditions?

LAST MONTH'S QUESTION

Client had taken Institute Cargo Clause A - 2009 plus War & Strikes - 2009 cover for importing bulk cargo. The term of Imports was CFR. The information provided at time of writing the risk was that when the ship reaches destination port, the bulk cargo will be bagged in the cargo hold of ship & then discharged from ship. On arriving at destination port, ship failed its mandatory safety inspection and was asked to go to anchorage & carryout specific repairs. Client decided to offload the cargo by barges & then bag the cargo at jetty. During transfer by barges the bulk cargo was damaged by sea spray. Buyer of cargo refused to accept cargo citing wet damages.
Client sought cargo damage claim under wet damages. Is the claim tenable?

ANSWER

Since the transit by barge was not contemplated at the time of underwriting and the client on his own decided to have cargo discharged into barges (which are presumed to be seaworthy) such discharge is in interruption of ordinary course of transit bringing the cover to an end. Therefore, insurer is not liable for the damage caused by sea spray. Further when the bulk cargo is discharged into barges sea spray may be inevitable and therefore loss if any is not caused by fortuity. Therefore, insurer is not liable

Please send your replies/answers ONLY to: marine.newslink@tataaig.com

CORRECT ANSWERS SENT BY: (In order of replies received)

• V Ganesan	Marsh India Insurance Brokers Pvt. Ltd., Chennai
• Sohag Parikh	Cadila Healthcare Ltd., Ahmedabad
• Punit Pandya	The New India Assurance Co. Ltd., Surat
• Devansh Patel	Suresh Desai & Associates, Surat
• Prashant Bhosale	Aditya Birla Insurance Brokers Pvt. Ltd., Koilkata
• Manish Shukla	
• Azad Kumar	UIB Insurance Brokers (India) Pvt. Ltd., Mumbai
• Hema Raghav	Optima Insurance Brokers Pvt Ltd., New Delhi
• Ashish Sharma	Shree Cement Ltd., Ajmer
• Bharat Bhushan	Optima Insurance Brokers Pvt Ltd., New Delhi

IF YOU HAVE ANY COMMENTS / FEEDBACK PLEASE SEND IT TO

Shioram Balachandran (98206 34466)

SVP & National Head - Marine

Email: marine.newslink@tataaig.com

Capt. Vijay Pal Singh (98330 60959)

Marine Loss Control Engineering (India)

Email: marine.newslink@tataaig.com

CONTACT US

Tata-AIG General Insurance Company Limited,

15th Floor, Tower A, Peninsula Business Park,

G.K. Marg, Lower Parel, Mumbai 400013.

www.tataaig.com