

Product Safety Summary

Toluene Diisocyanate

This Product Safety Summary is intended to provide a general overview of the chemical substance. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the Material Safety Data Sheet (MSDS) for the chemical substance.

Chemical Identity

Abbreviation :	TDI
CAS Number :	26471-62-5 for TDI Mixture 584-84-9 for 2,4-TDI 91-08-7 for 2,6-TDI
Common Names :	2,4-Toluene diisocyanate 2,6-Toluene diisocyanate Aromatic Diisocyanate Lupranate [®] T80

Product Overview

- Toluene Diisocyanate, (TDI) is a reactive material. Reactions of the reactive site of TDI (N=C=O) with polyol (-OH) functional materials produce polyurethane compounds.
- BASF's trademarks for TDI are Lupranate[®] T80 (North America), Lupranat[®] T80 (Europe) and SYStanat[®] TP80 (Europe and Asia).
- TDI is an important chemical building block in a wide variety of polyurethane applications, mainly used in the production of flexible polyurethane foams for furniture, bedding, carpet underlay and automotive seating.
- TDI is also used in the production of adhesives, coatings, sealants and elastomers.
- Like any reactive chemicals, TDI products can create hazards if handled carelessly. All persons associated with the transportation, storage or handling of TDI (or products containing TDI) must understand their hazards. This includes training in the recommended normal and emergency handling procedures.
- The primary hazard with TDI is the inhalation of its vapors. Airborne limits have been established for TDI vapor concentrations in the work environment. See Occupational Health and Safety Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) guidelines for these levels. Exposure to TDI may also cause skin irritation or even sensitization from exposure. Animal skin exposure has led to respiratory sensitization, however it is unknown what the effect is in humans
- For further safety and health information, the current Material Safety Data Sheet (MSDS) should be used for this substance.

Physical/Chemical Properties

- BASF's TDI is an 80:20 mixture of the 2,4-TDI and 2,6-TDI isomers assaying 99.5% TDI minimum.
- TDI is a clear, colorless liquid that has a strong pungent odor.

- The specific gravity of TDI is 1.22 and is denser than water and will sink to the bottom of water-filled containers.
- TDI reacts with water and can generate heat, however the reaction depends on temperature. If the temperature is below 50°C then the reaction is slow and at higher temperatures above 50°C the reaction becomes progressively more vigorous and can be violent. The reaction of TDI with water forms both carbon dioxide (CO₂) and insoluble polyurea compounds.
- TDI will also react with basic materials such as sodium hydroxide, ammonia, primary and secondary amines, acids and alcohols. Reaction with some of these products may be violent, generating heat, which can result in an increased evolution of TDI vapor and the formation of CO₂.

Health Information

Acute Hazards

TDI and products containing unreacted TDI are potentially hazardous materials. A thorough knowledge of potential dangers, with strict adherence to recommended safety practices, is essential before TDI products are handled, stored or used. Workers must be properly instructed and supervised in the handling of TDI. The primary hazard with TDI is the inhalation of its vapors. Limits have been established for allowable TDI vapor concentrations in the work environment. The OSHA permissible exposure limit (PEL) for TDI is 0.005 ppm as an 8-hour time weighted average (TWA) concentration and as a ceiling concentration limit of 0.02 ppm.

Effects on Respiratory System:

Exposure to TDI above allowable vapor concentrations may cause irritation to the mucous membranes of the upper and lower respiratory tracts. Even very brief exposure to TDI vapors may cause difficult or labored breathing, throat dryness, headaches and chest discomfort. Severe overexposure may result in bronchitis and pulmonary edema.

Effects on Eyes:

Brief exposure to TDI vapors may cause mild irritation and watering. The symptoms of direct contact to TDI liquid or high concentrations of vapors are severe watering, irritation and inflammation of the mucous membranes. Corneal opacity and discharge may result.

Effects on Skin:

Skin contact with TDI may result in irritation and a mild discoloration. Repeated or prolonged contact may cause redness, swelling, blistering or burns. Direct contact may produce skin sensitization, contact dermatitis and eczema from repeated exposures.

Effects on Ingestion:

The effects of ingestion include the irritation and burning of the mouth, esophagus and stomach. The harm that occurs will be a result of this irritation and not of any systemic toxicity.

Chronic Hazards

Exposure above the PEL may result in bronchitis, bronchial spasms and pulmonary edema. Long-term exposure to TDI has been reported to cause lung damage including reduced lung function that may be permanent.

Some individuals may develop a hypersensitivity to TDI vapors and may experience a severe reaction when exposed to TDI vapors at concentrations below established guidelines. Symptoms of hypersensitivity to TDI may include wheezing, shortness of breath and difficulty in breathing (See Sensitization)

Sensitization

Sensitization is an affect whereby a physiological response is caused by re-exposure to a very low concentration of chemical in an individual following higher, initial acute exposure or following chronic exposures. The response may be immediate, delayed or both.

The PEL values and ceiling limits should be sufficiently low to prevent sensitization in most individuals. However, allergic reactions may occur in sensitized individuals at concentrations well below these values. Once sensitized, individuals should be excluded from further exposure. If sensitized individuals continue to work with TDI, the time period between exposure and onset of symptoms may be shortened and the severity of the symptoms may increase.

To determination of what constitutes a significant TDI exposure can be difficult. The minimum concentration of TDI in the atmosphere that will cause subjective symptoms and objective physical findings in any given individual is unknown. Responses in sensitized individuals vary considerably from one individual to another.

Environmental Information

Any release to the environment of over 100 lbs. must be reported to the NRC and the local planning commission as outlined under EPCRA regulations. Each plant should have a system for dealing with emergencies within the plant to limit environmental release.

TDI will react with water to form carbon dioxide (CO₂) and insoluble polyurea compounds, which are not biodegradable but chemically inert. Because of this reaction, all unreactive TDI release to the environment would be consumed when exposed to water, water in the air or water in the ground.

Environmental toxicity test data from several animal species shows that TDI is practically nontoxic or not appreciably toxic to animals.

Additional Hazard Information

Because of the reaction of TDI with water, care should be taken to prevent contact with water. The hazard associated with this reaction is the formation of CO₂ and in closed containers this could cause pressure build up or even rupture.

The following safety recommendations must be observed:

- Store TDI in a dry environment using dry nitrogen or a dry air pad¹
- Plug and cap all lines leading to and from storage tanks.
- Fittings and line connections should be maintained and stored in a dry environment.
- Do not tightly close any container of TDI that has been, or is suspected of having been, contaminated with water.

Exposure Potential

Exposure to the general public may occur in accidental situations. TDI and products containing TDI are not intended for the general use by the general public.

¹ Dry air or nitrogen should have a dew point below -40°C (-40°F).

TDI and products containing TDI are reactive and hazardous chemicals. TDI should only be handled by knowledgeable, well-trained personnel who thoroughly understand the hazards associated with the transportation, storage and use of the chemical.

Workplace exposure should be limited by the use of engineering controls. TDI vapors must be monitored and controlled below applicable regulatory limits. If possible, TDI should be processed within closed systems. When this is impractical, special consideration should be given to ventilation design to limit exposure.

Regulations involving hazardous chemicals are continually evolving and thus exposure guidelines are reviewed regularly and modified whenever new information dictates a change. It is important that all companies handling TDI products are aware of the current legislative requirements.

The guidelines established by OSHA, ACGIH, NIOSH and others, represent current thinking and are believed to be conservative and protective of occupational workers. There is not guarantee of absolute safety.

Risk Management

The potential hazards associated with TDI can be avoided if workers are adequately instructed in supervised on the proper procedures of handling TDI.

Every worker should be trained to realize that exposure to a hazardous chemical requires immediate washing of affected areas using large amounts of soap and water, and that immediate attention may markedly decrease the severity of any health effects. (See First Aid.) Do not wash affected area with solvents.

Protective clothing, gloves, boots and eye protection must be worn whenever there is any possibility of TDI exposure. Protective clothing shall be made of impervious materials. Soiled or contaminated clothing should be laundered or destroyed.

Proper respiratory protective equipment should be readily available and in good working order. Exhaust and ventilating equipment should be inspected and tested regularly to assure TDI vapors/aerosols are being controlled to acceptable levels.

Properly designed emergency showers and eyewash fountains should be placed in convenient locations wherever TDI is used. All employees should know the location and operation of this equipment. All equipment must be frequently inspected to make sure they are in proper working condition.

Federal/Science Findings

U.S. Environmental Protection Agency – Integrated Risk Information System (IRIS)
<http://www.epa.gov/iris/subst/0503.htm>

U.S Department of Labor – Occupational Safety and Health Administration (OSHA)
http://www.osha.gov/dts/chemicalsampling/data/CH_272400.html
http://www.osha.gov/dts/chemicalsampling/data/CH_272405.html

American Conference of Governmental Industrial Hygienists (ACGIH)
<http://www.acgih.org>

National Institute for Occupational Safety and Health (NIOSH)

<http://www.cdc.gov/niosh/topics/isocyanates>

Contact Information

<http://www.basf.com>

MSDS

http://worldaccount.basf.com/wa/PublicMSDS~en_US/Search

Center for the Polyurethanes Industry (CPI)

<http://www.polyurethane.org>

References

Lupranate is a registered trademark of BASF Corporation and Lupranat is a registered trademark of BASF Aktiengesellschaft.

Polyurethane TDI Handbook, BASF Corporation, May 2007

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