Safety Summary

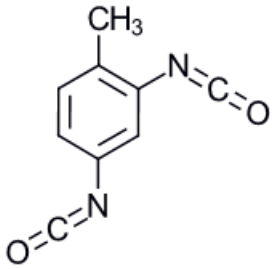
TDI, Toluene diisocyanate, and the following commercial products:

TDI 100, TDI 80/20 and TDI 65/35

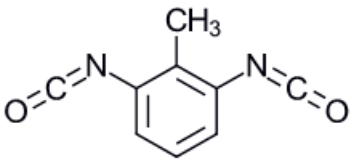
Toluene Diisocyanate, commonly referred to as TDI, is used in various polyurethane applications to manufacture finished parts, such as foams, cast elastomers, adhesives, sealants, fibres and some composites for other materials. The by far biggest application of toluene diisocyanates are flexible polyurethanes, both, slabstock and molded foams. These foams find applications as automotive cushions, carpet underlay, furniture, seating, and bedding.

TDI is also used as an intermediate for the synthesis of other chemical substances, utilizing its unique behaviour of two reaction groups with different reactivity in the same molecule.

TDI is commercially available in three different grades dependent on the ratio of its two isomers (2,4-TDI and 2,6-TDI) in the product.



2,4-TDI



2,6-TDI

This document is focussing on the mentioned TDI grades only and supplements the more comprehensive information contained in the respective extended safety data sheet (eSDS) of TDI suppliers and the outcome of chemical safety assessment of the relevant REACH registrations.

Chemical Identity

The pure 2,4-isomer is commercially available as TDI 100 (EC 209-544-5, CAS 584-84-9, LINK). It is a colourless to pale yellow solid at room temperature with a melting point of 21°C.

The most used isomer mixture contains 80% of the 2,4-isomer and 20% 2,6-isomer (EC 202-039-0, CAS 91-08-7) and is available as TDI 80/20, which solidifies at 9.5°C. Another commercially available mixture is TDI 65/35, consisting of 65% 2,4-TDI and 35% 2,6-TDI, and has a melting point of 4°C. Both isomer mixtures (EC 247-722-4, CAS 26471-62-5, LINK) are clear, colourless to pale yellow liquids with a sharp, pungent odour.

Physical Chemical Properties

	T 100	**T 80/20**	**T 65/35**
Molecular Formula	$C_9H_6N_2O_2$		
Molecular Weight (g/mol)	174.16		
CAS Registry Number	584-84-9	26471-62-5	
Melting Point/Freezing Point (°C)	21	9.5	4
Boiling Point (°C, at atmospheric Pressure)	252-254	252-254	253-255
Relative Density (g/cm³)	1.214 @ 25 °C	1.220 @ 20 °C	1.222 @ 20 °C
Flashpoint (°C)	131	132	128
Explosivity	not explosive	not explosive	not explosive

Classification and Labelling

GHS06: skull and crossbones  GHS08: health hazard 	Hazard statements: H330 Fatal if inhaled. H315 Causes skin irritation. H319 Causes serious eye irritation. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H317 May cause an allergic skin reaction. H351 Suspected of causing cancer. H335 May cause respiratory irritation. H412 Harmful to aquatic life with long lasting effects. Precautionary statements: P273 Avoid release to the environment P280 Wear protective gloves/ protective clothing/ eye protection/ face protection P284 Wear respiratory protection P308 + P313 If exposed or concerned: Get medical advice/attention P403+P233 Store in well-ventilated place. Keep container tightly closed P501 Dispose of contents/container to hazardous or special waste collection point Additional labelling requirements (CLP supplemental hazard statement): EUH204: Contains isocyanates. May produce an allergic reaction. As from 24 August 2023 adequate training is required before industrial or professional use.

Human Health

Health Effects

TDI is very toxic by inhalation exposure to vapours. Severe irritation of the respiratory tract, of the skin and of the eyes is the predominant acute health effect. Likewise, the strong irritating potential at the portal of entry should be considered for acute oral exposures.

TDI poses a strong sensitizing potential to both skin and respiratory tract. Sensitization of the respiratory tract may result in significant decreases in lung function in workers, an asthma-like reaction characterized by wheezing, dyspnea, and bronchial constriction. Animal studies and/or human evidence suggest that respiratory sensitization might also occur after skin contact.

In case of hypersensitivity of the respiratory tract and skin (e.g., asthmatics and those who suffer from chronic bronchitis and chronic skin complaint) it is inadvisable to work with the product. Symptoms affecting the respiratory tract can also occur several hours after overexposure

Toxicity following repeated exposure occurs locally at the site of contact. Repeated exposure to TDI vapours is resulting in irritation of the respiratory tract, no signs of systemic toxicity were observed in animal studies.

Tests assessing the mutagenic potential of TDI *in vitro* and *in vivo* provide no consistent evidence for a genotoxic activity. Chronic studies conducted on rodents indicated that oral exposure may result in tumour formation. However, the mechanism of tumour formation has shown to be not relevant for the inhalation route of exposure. Concordantly no indications for a carcinogenic potential were described in humans exposed to TDI vapours. Studies conducted in rats indicated that TDI vapours are not toxic to fertility or development.

Exposure to Human Health

The exposure potential to TDI is low since manufacturing and uses are restricted to specially dedicated facilities. All known and identified uses are limited to industrial/professional stages and thus no other than industrial and professional workers with special training and supervision handle the substance. Any uses by consumers are strictly advised against.

There where exposure can occur and of in case of unintended exposure due to accidents, appropriate risk measurements measure must be in place.

All identified uses in the industrial and professional segments for TDI have been proved to be safe by an in-depth human health exposure assessment conducted for TDI during REACH registration. For more detailed information see eSDS from supplier.

Environment

Environmental Effects

TDI is unstable in aqueous media where it reacts to form predominantly insoluble and inert polyureas.

TDI and its hydrolysis products are not readily biodegradable. No bioaccumulation is expected for TDI and the decomposition products. TDI has low to moderate toxicity for aquatic organisms.

Exposure to Environment

As TDI rapidly hydrolyses in contact with water (DT50 ranges from 0.5 to 30 min at ambient temperature), the substance is handled under rigorous containment by technical means under strictly controlled conditions during manufacturing and transport and use. Its uses are limited to special industrial and some professional applications with highly skilled and trained industrial/professional workers only, thus it can be concluded that the risk for exposure of TDI to the environment is low. There are no releases to the environment at industrial facilities since wastewater is treated in industrial wastewater treatment plants with adapted sludge. Any waste is subject to industrial incineration plants.

Due to the rapid decomposition in aqueous media, an exposure of sediment to TDI is negligible, a risk characterization for this compartment is therefore considered not to be relevant.

All identified uses in the industrial and professional segments for TDI have been proved to be safe by an in-depth environmental exposure assessment conducted for TDI during REACH registration. For more detailed information see eSDS from supplier.

Risk Management Recommendations

For more detailed information see eSDS from supplier.

We only support the industrial and professional uses of TDI under controlled conditions with appropriate technical and organisational conditions and measures as well as for the use suitable personal protective equipment (PPE). Adequate training is required before industrial or professional use.

General safety and hygiene measures

Do not breathe vapour/spray/aerosol.

When using the substance, make sure that there is adequate ventilation of stores and work areas. Refill and handle only in closed system. Provide suitable exhaust ventilation at the processing machines. Ensure thorough ventilation of work areas and stores. Avoid aerosol formation.

When handling heated product, vapours of the product should be ventilated, and additionally respiratory protection should be used. Wear respiratory protection, when spraying.

Articles freshly manufactured from diisocyanates can contain incompletely reacted diisocyanates and other dangerous substances, e.g. primary aromatic amines. With freshly manufactured articles from diisocyanates, suitable body protection and chemical resistant protective gloves is recommended. Completely cured polyurethanes can be handled without PPE.

Wearing of closed work clothing is required additionally to the stated personal protection equipment. Take off immediately all contaminated clothing. At the end of the shift the skin should be cleaned, and skin-care agents applied.

Keep away from food, drink, and animal feeding stuffs. No eating, drinking, smoking, or tobacco use at the place of work. Hands and /or face should be washed before breaks and at the end of shift.

Keep away from water and protect against moisture. Danger of bursting when humidity contaminated container is sealed gastight. Prevent material from entering drains/gutters.

Cover spilled material with neutralization solution (solution of 5-10 % sodium carbonate, 0.2-2 % detergent and 90-95 % of water), chemical absorbent or sand and shovel into buckets. Do not close buckets tightly as slow decomposition of the material releases carbon dioxide (danger of pressure build-up). Stir the mixture gently several times a day. Reaction progresses over 5-7 days at temperatures not below 20 °C.

Dispose of as hazardous waste in accordance with regulations.

Remark: Do use aprotic polar solvents (meeting the IUPAC definition) for cleaning up only with care, since it may lead to formation of hazardous primary aromatic amine (>0,1%). We use advice against all cleaning operations using aprotic polar solvents within widespread uses by professional workers.

Personal Protective Equipment

For more detailed information see eSDS from supplier.

Respiratory protection:
Personal protective equipment in case of vapour/aerosol release. Gas filter for gases/vapours of organic compounds (boiling point > 65°C, e.g., EN 14387 Type A). Particle filter with high efficiency for solid and liquid particles (e.g., EN 143 or 149, Type AP2.

Suitable respiratory protection for higher concentrations or longer-term use: Self-contained breathing apparatus.

Hand protection:
Chemical resistant protective gloves (Standard EN 374).
When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.

Suitable materials also with prolonged, direct contact (recommended: protective index 5 or higher, corresponding > 240 minutes of permeation time according to EN 374):
nitrile rubber (NBR) - 0.4 mm coating thickness
butyl rubber (butyl) - 0.7 mm coating thickness
chloroprene rubber (CR) - 0.5 mm coating thickness.
Thinner gloves may be used depending on the exposure time, glove supplier recommendations and related workplace assessment.

Unsuitable materials:
Polyvinylchloride (PVC) - 0.7mm coating thickness
Polyethylene-Laminate (PE laminate) – ca. 0.1 mm coating thickness.
Latex (natural rubber)

Eye protection:
Safety glasses with side-shields (frame goggles) (e.g., EN 166) or full-face respirator (EN 136) with organic vapor cartridge (meeting standard EN 14387).

Body protection:
Safety shoes (e.g., according to EN 20346)
Skin protection by closed clothing incl. long sleeves and long trousers

Contact information.

ISOPA Aisbl
Rue Belliard 65
1040 Bruxelles

Email: main@isopa.org
Website: www.isopa.org
Office : +32 27863553

ISOPA is the European trade association for producers of diisocyanates and polyols - the main building blocks of polyurethanes.

- ISOPA promotes the highest standards of best practice in the distribution and use of diisocyanates and polyols
- ISOPA ensures that all stakeholders can easily access accurate and up-to-date information on diisocyanates and polyols
- ISOPA shows how polyurethanes help fulfil society's present and future needs

Glossary:

Acute toxicity	harmful effects after a single exposure
Biodegradable	breakdown of materials by a physiological environment
Bioaccumulation	accumulation of substances in the environment
Carcinogenicity	effects causing cancer
Chronic toxicity	harmful effects after repeated exposures
GHS	Global Harmonized System
Hazard	situation bearing a threat to health and environment
Mutagenicity	effects that change genes
	combining teratogenicity, embryotoxicity and harmful
Reprotoxicity	effects on fertility
Sensitising	allergenic
PPE	Personal Protective Equipment
RPE	Respiratory Protective Equipment

Disclaimer:

Date of issue: April 2013 **Revision: January 2023**