

Information and recommendations for patients

- Patients exposed only to diisocyanate vapor do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid diisocyanates or solvents containing diisocyanates can secondarily contaminate rescue and medical personnel by direct contact or through evaporation of diisocyanates.
- Diisocyanates are severely irritating to all tissues, in particular to the respiratory tract. Exposure may result in eye and skin irritation, coughing, chest pain, dyspnea. Swelling of the throat and signs of accumulation of fluid in the lungs (shortness of breath, cyanosis, expectoration, cough) may occur.
- Asthmatic attacks (constriction of the bronchi with severe dyspnea) may occur after exposure to very low diisocyanate concentrations.
- There is no antidote to be administered to counteract the effects of diisocyanates. Treatment consists of supportive measures.

Substance information

Diisocyanates: TDI - $\text{CH}_3\text{C}_6\text{H}_3[\text{NCO}]_2$, CAS 26471-62-5 (mixture), CAS 584-84-9 (2,4-isomer), CAS 91-08-7 (2,6-isomer);
 MDI - $\text{CH}_2(\text{C}_6\text{H}_4[\text{NCO}])_2$, CAS 144490-96-0 (mixture), CAS 5873-54-1 (2,4'-isomer), CAS 101-68-8 (4,4'-isomer);
 HDI - $\text{C}_6\text{H}_{12}(\text{NCO})_2$, CAS 822-06-0

These guidelines are based on information about some of the most frequently used diisocyanates: toluene diisocyanate (TDI), diphenylmethane diisocyanate (MDI), and hexamethylene diisocyanate (HDI). Recommendations for other isocyanates might be similar. However, these guidelines do not cover special features potentially related to other isocyanates.

Synonyms: TDI, diisocyanatotoluene, tolylene diisocyanate; MDI, methylenediphenyl diisocyanate, methylene bis(phenylisocyanate); HDI, hexamethylene diisocyanate, diisocyanatohexane

At room temperature, TDI and HDI are colorless to straw-colored liquids while MDI monomer is a colorless solid. Diisocyanates have a fruity, pungent odor. Diisocyanates are highly reactive even to hydroxyl and amino groups in human body cells. When heated to decomposition, they emit toxic fumes of nitrogen oxides.

The major application of diisocyanates is the manufacture of polyurethane foams, various plastic materials, and elastomers. In addition, diisocyanates are used as hardeners for paints, coatings, and adhesives.

What immediate health effects can result from exposure to diisocyanates?

Most exposures to diisocyanates occur from breathing the vapor. Exposure to small amounts irritates the eyes, nose, throat and lungs causing cough, chest pain, and shortness of breath. Higher exposure levels can cause severe breathing difficulty, inflammation of the lung, and accumulation of fluids in the lung.

Are any future health effects likely to occur?

A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. However, some persons develop allergies even after a single diisocyanate exposure. In these people, a very low diisocyanate concentration may trigger future asthma attacks. After serious or repeated exposures permanent breathing difficulty might develop. Eye and skin exposure to liquid diisocyanates may result in permanent tissue damage.

Follow-up instructions

Keep this page and take it with you to your next appointment. Follow only the instructions checked below.

- () Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:
 - coughing or wheezing
 - difficulty breathing or shortness of breath
 - increased pain or a discharge from exposed skin or eyes
 - chest pain or tightness
- () No follow-up appointment is necessary unless you develop any of the symptoms listed above.
- () Call for an appointment with Dr. _____ in the practice of _____
When you call for your appointment, please say that you were treated in the Emergency Department at _____ Hospital by _____ and were advised to be seen again in ___ days.
- () Return to the Emergency Department/_____ Clinic on (date) _____ at _____ am/pm for a follow-up examination.
- () Do not perform vigorous physical activities for 1 to 2 days.
- () You may resume everyday activities including driving and operating machinery.
- () Do not return to work for ___ days.
- () You may return to work on a limited basis. See instructions below.
- () Avoid exposure to cigarette smoke for 72 hours; smoke may worsen the condition of your lungs.
- () Avoid drinking alcoholic beverages; alcohol may worsen your clinical condition.
- () Avoid taking the following medications: _____

- () You may continue taking the following medication(s) that your doctor(s) prescribed for you: _____

- () Other instructions: _____

Signature of patient _____ Date _____
Signature of physician _____ Date _____

References

Berufsgenossenschaft der chemischen Industrie, Hrsg. Polyurethan-Herstellung / Isocyanate. Heidelberg: Jedermann-Verlag, 1997. (Merkblätter für gefährliche Arbeitsstoffe; M 044.)

Bock W, Hahn JU, Stamm R, Stückrath M. BIA-Report Isocyanate. Sankt Augustin: Hauptverband der gewerblichen Berufsgenossenschaften (HVBG), 1995.

Buttgereit F, Dimmeler S, Neugebauer E, Burmester GR. Wirkungsmechanismen der hochdosierten Glucocorticoidtherapie. Dtsch Med Wschr 1996; 121: 248-252.

Diller WF. Anmerkungen zum Unglück in Bhopal. Dtsch Med Wschr 1985; 110: 1749-1751.

Goldfrank LR, Flomenbaum NE, Lewin NA, Weisman RS, Howland MA, Hoffman RS. Toxicologic Emergencies. 6th ed. Norwalk: Appleton & Lange, 1998: 1540-1541.

Micromedex, Inc.: Tomes CPS™ Medical Management: Toluene Diisocyanate, 1995.

Raffle PAB, Adams PH, Baxter PJ, Lee WR, ed. Hunter's Diseases of Occupations. 8th ed. London: Edward Arnold Publishers, 1994: 474-475.

Thiess AM. Vergiftungen durch Industriestoffe, Teil 1 + 2. Sicherheitsingenieur 1972; 4/72: 164-168, 5/72: 213-216.

U.S. Department of Health & Human Services - Agency for Toxic Substances and Disease Registry, ed. Toluene Diisocyanate. Atlanta, 1994. (Managing Hazardous Materials Incidents; vol III.)

Foncerrada G et al, Safety of Nebulized Epinephrine in Smoke Inhalation Injury, J Burn Care Res 2017;38:396–402

Walker PGF et al, Diagnosis and management of inhalation injury: an updated review, Critical Care (2015) 19:351

Olasveengen TM, Semeraro F, et. Al: European Resuscitation Council Guidelines 2021: Basic Life Support. Resuscitation 2021, 161: 98-114