

November 2015



## Properties, Hazards and Safety Information for HDI\*

**Product: HDI (Hexamethylene-1,6-diisocyanate; CAS No. 822-06-0)**

### Physical and chemical data

Physical state	liquid
Colour	Colourless
Odour	pungent
Melting point/range	approx. -67°C
Boiling point/range	approx. 255°C (1013hPa)
Flash point	approx. 130°C
Ignition temperature	approx. 454°C
Lower/upper explosion limit	0.9/9.5% (Vol.)
Vapour pressure	approx. 0.007hPa (20°C)
Density	approx. 1.05 (20°C)
Water solubility	insoluble, reacts with water
Viscosity	approx. 2.4 mPas (20°C)
Hazardous decomposition products	no dangerous decomposition products if properly stored and handled
Hazardous reactions	with amines, alcohols, acids and alkali; decomposes in water with formation of CO <sub>2</sub> (leading to an increase in pressure in closed containers!)

**\* More detailed information should be taken from the suppliers' Material Safety Data Sheets**

## Toxicological Information

### Short term exposure

Ingestion	Following bolus application in animals moderate acute toxicity was observed: LD <sub>50</sub> (rat) = 746 mg/kg. Ingestion may irritate the gastro-intestinal tract.
Skin contact	HDI is strongly irritant to corrosive upon skin contact and can result in sensitization.
Eye contact	HDI is strongly irritant to corrosive to the mucous membranes of the eyes.
Inhalation	Inhalation of HDI-vapors is toxic (LC50, rat = 0.124-0.35 mg/l/4 hours). The high toxicity can be related to lung damage due to the highly irritant/corrosive properties of HDI vapors. Concentration-dependent signs of respiratory tract irritation can be observed (e.g. bradypnea, dyspnea, edema, cyanosis, respiratory tract inflammation). Inhalation may result in respiratory tract sensitization and in sensitized people very low concentrations may lead to asthmatic symptoms, the onset of which may be delayed.

### Repeated exposure

Skin contact	Local skin irritation is the primary health effect following repeated dermal contact to HDI. Furthermore sensitization may occur.
Inhalation	Local irritation of the respiratory tract is the primary health effect following repeated inhalation of HDI-vapors. In rodents the upper respiratory tract (in particular the nasal cavity) was identified as the most sensitive tissue, progressing into lower areas of the respiratory tract with increasing vapor concentrations. HDI does not pose a neurotoxic hazard but may cause sensitization by inhalation.
Carcinogenicity	In a combined chronic toxicity/oncogenicity inhalation study no evidence of HDI related carcinogenicity was found.
Reproductive toxicity	In inhalation studies, HDI had no adverse effect on reproductive organs and reproduction parameters of rats. Likewise no signs of developmental toxicity were observed.

### Exposure controls/Personal protection equipment

General	Workers with a hypersensitivity of the respiratory tract and/or the skin (e.g. asthmatics or those suffering from chronic bronchitis or chronic skin complaint) should not be exposed to this chemical.					
OELs	In many countries occupational exposure limits for HDI have been set up. These can be found under →OELs HDI (see website under Library – Regulatory Information)					
DNEL	Application Area	Workers	Workers			
	Route of Exposure	Inhalation	Inhalation			
Health Effect		Acute - local effects	Long-term - local effects			
	mg/m <sup>3</sup>	0.07 mg/m <sup>3</sup>	0.035 mg/m <sup>3</sup>			
PNEC	PNEC <sub>freshwater</sub>	PNEC <sub>marine water</sub>	PNEC <sub>STP</sub>	PNEC <sub>sediment freshwater</sub>	PNEC <sub>sediment marine water</sub>	PNEC <sub>soil</sub>
	0.0774 mg/L	0.00774 mg/L	8.42 mg/L	>0.01334 mg/kg	>0.001334 mg/kg	>0.026 mg/kg

Respiratory protection	Respiratory protection is required if an inhalative exposure can not be excluded. Depending on the exposure scenario relevant for the interesting application more details are given in the extended MSDS of the supplier..
Hand protection	Chemical resistant protective gloves should be worn, e.g. <ul style="list-style-type: none"> <li>- butyl rubber with a thickness <math>\geq 0.5</math> mm (breakthrough time <math>\geq 480</math> min)</li> <li>- fluorinated rubber with a thickness <math>\geq 0.4</math> mm (breakthrough time <math>\geq 480</math> min)</li> </ul> Contaminated gloves should be disposed of.
Body protection	Body protection should be chosen based on activity and possible exposure, e.g. apron, protecting boots, chemical-protection suit.
Eye protection	Face protection/close-fitting protective goggles should be worn.

### First aid measures

General	Contaminated clothing must be taken off immediately.
Skin contact	Wipe off mechanically and wash affected areas thoroughly with soap and water for at least 15 minutes. Dispose of contaminated clothing or wash thoroughly before reuse. For severe exposures, the affected person should get under a safety shower, using the flushing action of the water to remove the bulk of the chemical, then remove contaminated clothing and wash skin with soap and water. Seek medical attention. For lesser exposures, the individual should seek medical attention if irritation develops or persists after the area is washed.
Inhalation	The person should move to an area free from risk of further exposure. Oxygen or artificial respiration should be administered as needed. Asthmatic-type symptoms may develop and may be immediate or delayed up to 24 hours. Treatment is essentially symptomatic. A physician should be consulted.
Eye contact	Flush with large amounts of lukewarm water for at least 15 minutes, holding eyelids open all the time. Refer the affected individual to an eye specialist or other physician for immediate follow-up.
Ingestion	Vomiting should not be induced and nothing should be given orally to an unconscious or convulsing person. A physician should be consulted.

### Ecological information

Biodegradability	HDI is not readily biodegradable. It reacts with water forming solid insoluble polyurea, hexamethylene diamine (HDA) and CO <sub>2</sub> . HDA is inherently biodegradable, while polyurea is more or less inert and – due to its molecular size – not bioavailable.
Bioaccumulation	Due to hydrolysis in water bioaccumulation of HDI is not expected. Bioaccumulation of the hydrolysis product HDA is also not expected due to its high solubility and its low Kow.
Acute toxicity to aquatic organisms	HDI offers a low level of aquatic toxicity. It is not toxic to aquatic organisms up to its limit of solubility in water <ul style="list-style-type: none"> <li>- LC0 (fish, Brachydanio rerio, 96h) <math>\geq 82.8</math>mg/l</li> <li>- EC50 (bacteria) = 842mg/l</li> <li>- EC0 (Daphnia magna, 48 h) <math>\geq 89.1</math>mg/l</li> <li>- EC50 (algae, Scenedesmus subspicatus, 72h) <math>\geq 77.4</math>mg/l</li> </ul>



## EC Classification and labeling

### A. According CLP regulation 1272/2008

#### 1. Classification according Annex VI, Table 3.1 (legally binding)

Hazard class	Category	Hazard phrase
Acute Toxicity	4	H302: Harmful if swallowed
Acute Toxicity	1	H330: Fatal if inhaled
Skin Corrosion/Irritation	2	H315: Causes skin irritation
Eye irritation/damage	2	H319: Causes serious eye irritation
Respiratory sensitization	1	H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled
Skin sensitization	1	H317: May cause an allergic skin reaction
STOT single exposure	3	H335: May cause respiratory irritation

**2. Labeling according regulation 1272/2008 (CLP)  
According Annex VI, Table 3.1 (legally binding)**

Pictograms	 
Signal word	Danger
Hazard statement	H302: Harmful if swallowed
	H330: Fatal if inhaled
	H315: Causes skin irritation.
	H319: Causes serious eye irritation
	H334: May cause allergic or asthma symptoms or breathing difficulties if inhaled
	H317: May cause an allergic skin reaction
	H335: May cause respiratory irritation

**B.) Classification and labeling according Annex VI, Table 3.2 of regulation 1272/2008 (CLP)**

Symbols	T	Toxic
Risk phrases	R23 R36/37/38	Toxic by inhalation Irritating to eyes, respiratory system and skin.