

GPS Safety Summary

MDI, Methylenediphenyl-diisocyanate , covers all commercially available products deriving from the pure 4,4'-MDI (CAS 101-68-8), its structural isomers 2,4'-MDI (CAS 5873-54-1) and 2,2'-MDI (CAS 2536-05-2), MDI mixed isomers (CAS 26447-40-5), both "oligomeric MDI" (CAS 32055-14-4) and "polymeric MDI" (CAS 9016-87-9) as well as the modified reaction products such as MDI Homopolymer (CAS 25686-28-6), MDI/DPG (CAS 88288-99-7), MDI/TPG (CAS 75880-28-3), MDI/1,3-BD/TPG/PG and MDI/MDI Homopolymer/1,3-BD/TPG/PG (EC 500-313-7)

MDI (Methylenediphenyl-diisocyanate) is one of the most commonly used raw materials for Polyurethanes in the world.

There are several world scale plants around the globe, where these raw materials are manufactured. They all start from Benzene via Nitrobenzene to Aniline, which together with Formaldehyde, is further converted into MDA (methylenediphenyldiamine) and finally into crude MDI.

Crude MDI contains the pure 4,4'-MDI-, its 2,4'-MDI- and 2,2'-MDI-isomers, which are due to their chemical structure called "2-ring-isomers", indicating that two phenyl rings are connected via one methylene group.

Besides these monomeric units, there are also higher-ring-isomers, in which one phenyl ring bears more than one methylene group, which again is connected to other phenyl ring units. Most of these higher oligomers comprehend 3- and 4-ring homologs. Each homolog contains various isomers, e.g. EC 244-233-8 for a 3-ring isomer, EC 286-872-5 for a 4-ring and CAS 85423-11-6 for a 5-ring isomer. The statistical nature of the polymerisation means that numerous isomers are possible for each molecular weight and hence these are not single constituents.

The composition of the crude MDI strongly depends on the manufacturing process. Usually they all result in high yields of the 2-ring isomers, 4,4'-MDI, and its mixtures with 2,4'-MDI. These 2- ring isomers are separated off by distillation and further purification steps. Dependent on the extent of separation during distillation of the 2-ring isomers, different types of oligomeric or even polymeric MDI's remain as residue, which are composed of higher-ring-isomers and the varying contents on 2-ring-isomers.

Substance	Name	CAS No	EC/ECHA No
4,4'-MDI	4,4'-methylenediphenyl diisocyanate	101-68-8	202-966-0
2,4 -MDI	o-(p-isocyanatobenzyl)phenyl isocyanate	5873-54-1	227-534-9
MDI mixed Isomers	Reaction mass of 4,4 -methylenediphenyl diisocyanate and o-(p-isocyanatobenzyl)phenyl isocyanate		905-806-4
	1,1'-methylenebis(isocyanatobenzene)	26447-40-5	247-714-0
Oligomeric MDI	Formaldehyde, oligomeric reaction products with aniline and phosgene	32055-14-4	500-079-6
MDI Homopolymer	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with 2,4'-diisocyanatodiphenylmethane	109331-54-6	500-297-1
	4,4'-(and 2,4 -)Methylenediphenyl diisocyanate, oligomers	25686-28-6	500-040-3
	Reaction mass of 4,4'-Methylenediphenyl diisocyanate, oligomers and 4,4'-methylenediphenyl diisocyanate		905-845-7
MDI-DPG	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with oxydipropanol	59952-43-1	500-142-8
	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with 2,4'-diisocyanatodiphenylmethane and oxydipropanol (merged to CAS# 59952-43-1, NLP 500-142-8, only one dossier generated)	88288-99-7	500-270-4
MDI-TPG	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with [(methylethylene)bis(oxy)]dipropanol	52747-01-0	500-119-2
	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with 2,4'-diisocyanatodiphenylmethane and [(methylethylene)bis(oxy)]dipropanol	75880-28-3	500-262-0
MDI/MDI Homopolymer/1,3-BD/TPG/PG	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with butane-1,3-diol, 2,4'-diisocyanatodiphenylmethane, 1,1'methylenebis(4-isocyanatobenzene) homopolymer, [(methylethylene)bis(oxy)]dipropanol and propane-1,2-diol		500-313-7
MDI/1,3-BD/TPG/PG	4,4'-Methylenediphenyl diisocyanate, oligomeric reaction products with butane-1,3-diol, 2,4'-diisocyanatodiphenylmethane, [(methylethylene)bis(oxy)]dipropanol and propane-1,2-diol	123714-19-2	500-312-1
PMDI	Diphenylmethane Diisocyanate, isomers and homologues	9016-87-9	618-498-9

This document shall summarize the commonly used MDI's which are commercially available in high volumes. The different MDI products are named in the following table:

In accordance with their structure and low molecular weight, the pure isomers and isomer mixtures respectively are used as such and after further modification via pre-polymerization with low molecular weight diols or chain extenders, and to some extent with higher functional molecules. These products are used to manufacture flexible Polyurethanes foams, elastomers, fibers and many other applications with tailor made properties.

The higher-ring-isomers are usually used for the production of rigid foams as insulating materials in construction and appliances and other applications, such as CASE (Coatings, Adhesive, Sealants, Elastomers), where a high degree of crosslinking in the polymers provide the required properties.

Like many reactive chemicals, “MDI products”¹ can create hazards if handled carelessly. The purpose of this publication is to outline precautions to take in handling diisocyanates under normal and emergency situations. All persons associated with the transportation, storage, or handling of MDI must be thoroughly familiar with the potential hazards and trained in the recommended normal and emergency handling procedures. All users of MDI products must be fully informed on the most current guidelines and regulations of all applicable authorities. Users of MDI are strongly urged to consult the appropriate regulatory authorities before finalizing specifications for processing, handling, and storage equipment. The current Safety Data Sheet (SDS) should be used in conjunction with this publication because the SDS is updated as changes in regulatory requirements occur.

Chemical Identity

Composition and structure for the main MDI types/products are summarized in the following tables:

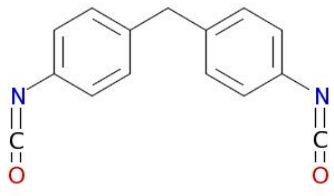
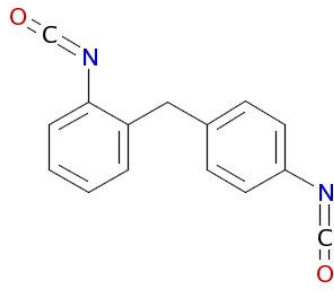
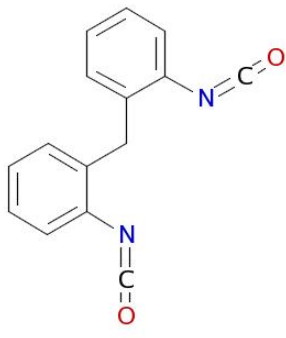
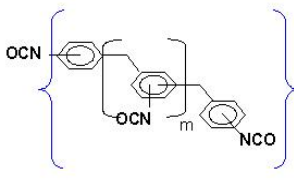
Composition of the main MDI products²:

MDI product/type	Content (w/w%)				
	4,4'-MDI	2,4'-MDI	2,2'-MDI	2-ring MDI	Higher oligomers
4,4'-MDI	80 – 100	0 – 20	0 – 5		0 – 5
2,4'-MDI	0 – 20	80 – 100	0 – 5		0 – 5
MDI mixed Isomers	25 – 80	10 – 70	0 – 5		0 – 5
Oligomeric MDI	25 – 85	1 – 50	0 – 10		5 – 60
Polymeric MDI, PMDI	20 – 49			< 50	50 – 80
MDI Homopolymer	5 – 85	0 – 65	0 – 5		15 – 50
MDI/1,3-BD/TPG/PG	10 – 90	0 – 70	0 – 5	35-90	10 – 65
MDI/DPG	10 – 90	0 – 70	0 – 5		10 – 60
MDI/MDI Homopolymer/1,3-BD/TPG/PG	10 – 90	0 – 70	0 – 5	35-90	10 – 65
MDI/TPG	10 – 90	0 – 70	0 – 5		10 – 60

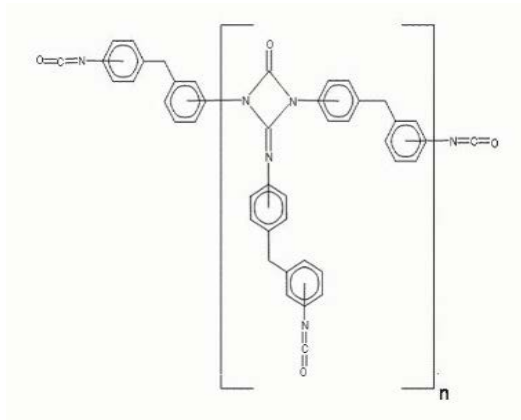
¹ Reference is made to: MDI-Handbook, BASF: In this handbook, the term “MDI products” is often used interchangeably with terms such as “MDI”, “MDI-containing products”, and “MDI materials”.

² All MDI types have been registered under REACH, with the exemption of PMDI, which is a Polymer.

Structural formulas:

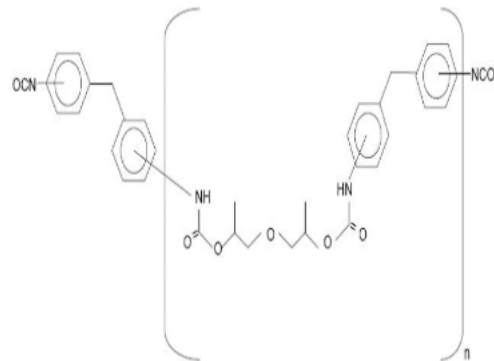
<p style="text-align: center;">4,4'-MDI</p>  <p style="text-align: center;">C₁₅H₁₀N₂O₂ Mweight : 250.26</p>	<p style="text-align: center;">2,4'-MDI</p>  <p style="text-align: center;">C₁₅H₁₀N₂O₂ Mweight : 250.26</p>
<p style="text-align: center;">2,2'-MDI</p>  <p style="text-align: center;">C₁₅H₁₀N₂O₂ Mweight : 250.26</p>	<p style="text-align: center;">oligomeric/ polymeric MDI (m >= 1) *</p>  <p style="text-align: center;">*The higher oligomers of MDI are all those structures for which m is greater than or equal to 1.</p> <p style="text-align: center;">C₇ H₄ N O [C₈ H₅ N O]_m C₈ H₆ N O mmean = 0.33 (range 0.10 – 0.80) Mweight: >=263<=329</p>

MDI Homopolymer



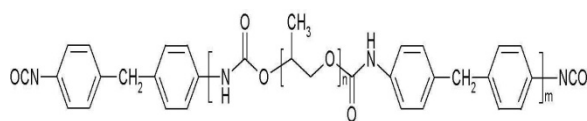
$C_{14} H_{10} N O [C_{29} H_{20} N_4 O_2]_n NCO$
 $n_{mean} = \text{typical } 0.11 (0.06 - 0.65)$
 Mweight: $\geq 277 \leq 546$

MDI/DPG



$C_{14} H_{10} N O [C_{21} H_{24} N_2 O_5]_n NCO$
 $n_{mean} = 0.18 (0.02 - 0.21)$
 Mweight: av. ~ 319

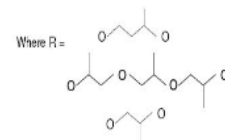
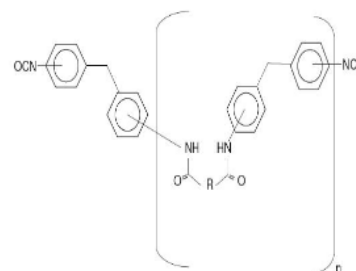
MDI/TPG



$n = 3, 0 < m < 5$

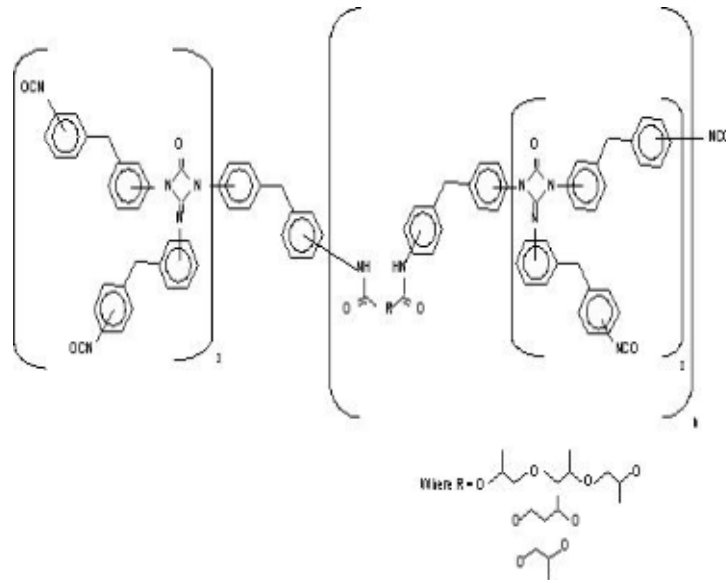
$(C_{15} H_{10} N_2 O_2 \cdot C_9 H_{20} O_4)_x$
 Mweight: $>250 <2000$

MDI/1,3-BD/TPG/PG



$C_{14} H_{10} N O (R C_{15} H_{12} N_2 O_2)_n NCO$
 where
 $R = C_4 H_8 O_2$ and $C_9 H_{18} O_4$ and $C_3 H_6 O_2$
 Mweight: ca. 365

MDI/MDI Homopolymer/1,3-BD/TPG/PG



Uses and Applications³:

MDI is widely used as Polyurethane component all over the world. Due to its chemical structure, it offers the processing of tailor made materials for a broad variety of applications. It can be used as pure substance or in its modified forms, as prepolymers or in its oligomeric/ polymeric form as such or as mixtures with those. For example, elastomeric fibers produced with MDI are widely used in sport clothing, such as bathing and bike suits. Other sport & leisure applications are skiing boots, gloves and shoe soles. As major Polyurethane component, the different MDI's are used in coatings and filament applications, window encapsulation, sunroofs, crash pads, steering wheels, hoses, tubes, flexible foams for automotive seating, acoustic applications, furniture and many other products, which are commonly used in both, high-tech and broad commodity applications. In particular, the higher crosslinked MDI products, e.g. PMDI, are extensively used to manufacture rigid foams for all kind of insulations, such as appliances, e.g. refrigerators, and construction, e.g. sandwich panels and spray foams in both, industrial and residential buildings. Products for foundry and CASE applications

³ Reference is made to:

- a. Kirk-Othmer, Encyclopedia of Chemical Technology, John Wiley & Sons
- b. Ullmann's, Encyclopedia of Industrial Chemistry, John Wiley & Sons
- c. G. Örtel, Polyurethane Handbook, Hanser Publishers

are usually non cellular and distinguish themselves through high abrasion resistance, strong weatherability, and excellent durability in their general chemical and physical properties.

The following summary will cluster the different MDI types according to their composition, i.e. their content on 2-ring isomers 4,4'-MDI and 2,4'-MDI in particular. Thus, summarizing the monomeric, oligomeric/polymeric and modified MDI's, the physico-chemical, toxicological and ecotoxicological properties will be shown for these three groups.

Physical/Chemical Properties

1. Overview of physico-chemical properties for the monomeric MDI's

Property	Value		
	4,4'-MDI	2,4'-MDI	mixed isomers
Substance	4,4'-MDI	2,4'-MDI	mixed isomers
Form	substance	substance	mixture
Physical state	solid	solid	liquid
Melting point	39-43°C	34-38°C	10.7 – 9.3 °C
Boiling point	> 300°C at 1013 hPa Decomposes, Polymerises	decomposition at 241°C	> 300°C
Colour	white to light yellow	off-white	pale to yellow/red
Odour	Slightly musty	--	slightly musty
Relative density	1.32 g/cm ³ at 20°C	1.24-1.32 g/cm ³ at 20°C	1.24 - 1.32 g/cm ³ at 20°C
Vapour pressure	0.00062 Pa at 20°C	0.0014Pa at 20°C.	range 0.00062 – 0.0014 Pa at 20°C
Mol weight	250.26	250.26	250.26
Flammability	non flammable	non flammable	non flammable
Explosive properties	non explosive	non explosive	non explosive
Self-ignition temperature	> 601°C	> 601°C	> 600 °C
Water solubility	6.8 mg/L at 25°C. Reacts with water and generates CO ₂	7.5 mg/l at 25°C	6.8 mg/L at 25°C.
Flash point	if molten: 211 °C at 1013 hPa	> 200 °C	208.5 °C at 1013 hPa

Property	Value		
	Partition coefficient n-octanol/water (logPow value)	4.51 at 22°C	4.51 at 22°C

2. Overview of physico-chemical properties for the oligomeric/polymeric MDI

Property	Value	
	olig. MDI	polym. MDI
Substance	olig. MDI	polym. MDI
Form	mixture	mixture
Physical state	liquid	liquid
Melting point	5°C	5°C
Boiling point	> 300 °C (at 1011 hPa)	> 300 °C (at 1011 hPa)
Colour	brown	brown
Odour	--	--
Relative density	1.24 g/cm ³ at 20°C	1.24 g/cm ³ at 20°C
Vapour pressure	< 0.0009 Pa at 20°C	< 0.0003 Pa at 20°C
Molweight	>=263<=329	>=263<=329
Flammability	non flammable	nd
Explosive properties	non explosive	non explosive
Self-ignition temperature	> 600 °C	> 600 °C
Water solubility	6.8 mg/L at 25°C	nd
Flash point	217.5 °C at 1013 hPa	>208°C at 1000 hPa
Partition coefficient n-octanol/water (logPowvalue)	4.51 at 22°C	nd

3 a. Overview of physico-chemical properties for the modified MDI (prepolymers group 1)

Property	Value		
	MDI-DPG	MDI Homopolymer	MDI-TPG
Substance	MDI-DPG	MDI Homopolymer	MDI-TPG
Form	mixture	mixture	mixture
Physical state	liquid at RT	liquid at RT	liquid at RT
Melting point	- 12.2 – 74.7°C	-17 to -4.7 °C	19.2 – 21.3 °C
Boiling point	decomposes at 165°C	decomposition at 201°C	> 265°C at 1013 hPa
Colour	--		colourless
Odour	--	--	--
Relative density	1.112 g/cm ³ at 20°C	1.22 g/cm ³ at 20°C	1.19 g/cm ³ at 20°C
Vapour pressure	9.42*10-03 Pa at 20°C 1.34*10-02 Pa at 25°C	5.92 * 10-03 Pa at 20°C 9.55 * 10-03 Pa at 25°C	0.00246 Pa at 20°C
Molweight	319	>=277 <=546	>250 <2000
Flammability	non flammable	non flammable	non flammable
Explosive properties	non explosive	non explosive	non explosive
Self-ignition temperature	none	none	495 °C at 1013 hPa
Water solubility	5.58e-05 g.L-1	5.17 E- 08 g.L-1	nd
Flash point	218°C @ 101.3 kPa	221°C @ 101.3 kPa	220 °C at 1013 hPa
Partition coefficient n-octanol/water (logPow value)	5.98 at 20°C	8.56 at 20°C	9.11 at 20°C

3 b. Overview of physico-chemical properties for the modified MDI (prepolymers group 2)

Property	Value	
	MDI/1,3-BD/TPG/PG	MDI/MDI Homopolymer/1,3-BD/TPG/PG
Substance	MDI/1,3-BD/TPG/PG	MDI/MDI Homopolymer/1,3-BD/TPG/PG
Form	mixture	mixture
Physical state	liquid	liquid
Melting point	> -14.1 < -2.5 °C	>= -16.5 <= -12.3 °C
Boiling point	decomposition at 193°C	decomposition at 167°C
Colour	--	--
Odour	--	--
Relative density	1.225 g/cm ³ at 20°C	1.23 g/cm ³ at 20°C
Vapour pressure	6.57 * 10 ⁻⁰⁴ Pa at 20°C	2.45 * 10 ⁻⁰³ Pa at 20°C
Molweight	ca. 365	nd
Flammability	non flammable	non flammable
Explosive properties	none explosive	non explosive
Self-ignition temperature	none	none
Water solubility	3.65e-05 g.L-1 Estimated	1.45e-16 g.L-1 Estimated
Flash point	>230°C (closed cup)	> 210°C (closed cup)
Partition coefficient n-octanol/water (logPow value)	15.98 at 20°C (estimated)	15.98 at 20°C

Health Effects

MDI is classified as Carc. Cat. 2/H351 “suspected of causing cancer” according to GHS/CLP and Cat.3/ R40 , “limited evidence of a carcinogenic effect” under DSD-DPD respectively, in the EU under the classification and labelling legislation.

In summary, primary hazards with MDI are inhalation of aerosols and skin contact. According to the ECHA Guidance on information requirements and chemical safety assessment⁴ a national occupational exposure limit (OEL) was used as a surrogate for a DNEL. For MDI and polymeric MDI the German MAK Commission established an OEL (MAK value) of 0.05 mg/m³ for inhalable aerosol referring to an 8-h exposure period. This OEL is used as a surrogate DNEL for long-term exposure. This OEL is used as a surrogate DNEL for long-term exposure. A ceiling limit of 0.1 mg/m³ was settled. This ceiling limit is used as a surrogate DNEL for short-term exposure⁶. The justification for these OEL’s is published⁵.

Human Health Safety Assessment

- **Industrial Workers:** Exposure is very unlikely, industrial workers will not come into contact with MDI, as the substances are manufactured and handled in industrial settings in closed systems under strictly controlled conditions only. For manufacturing, transport and their subsequent intermediate uses rigorous containment is applied.
In case of unintended exposure due to accidents, appropriate Risk Management Measures are in place.
Only specially and highly trained industrial workers handle the substances.
- **Professional workers :** Exposure risks are carefully controlled, since uses (e.g. spray foam and coatings) are limited to specially trained persons with corresponding PPE, personal protective equipment.
- **Consumer:** Exposure is unlikely, these products are regulated via use restrictions according Annex XVII of REACH.

Since all MDI product types are deriving from monomeric MDI, and the 4,4’-MDI and its 2,4’-MDI isomers are the major components also in the oligomeric/polymeric MDI, as well as in the modified MDI’s (prepolymers), the effect assessment for all MDI types result in a very uniform pattern.

⁴ Chapter R.8 (May 2008)

⁵ German MAK Commission (MAK, 2008)

⁶ See document “PNEC’s & DNEL’s of MDi “ on Isopa web site

Effect assessment for the category group of all monomeric, oligomeric and modified MDI`s which have been registered under REACH.

Effect Assessment	Result	
Acute Toxicity oral / inhalation / dermal	Harmful if inhaled.	
Irritation / corrosion skin / eye / respiratory tract	Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.	
Sensitization	May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.	
Toxicity after repeated exposure oral / inhalation / dermal	May cause damage to respiratory system.	
Genotoxicity / Mutagenicity	No mutagenic potential	--
Carcinogenicity	Suspected of causing cancer.	
Toxicity for reproduction	No reprotox potential	

Environmental Effects

Environmental Safety Assessment

MDI quickly reacts with water and hence, MDI will rapidly be hydrolyzed upon contact with water, soil and sediment. Hydrolysis is considered to be the main removal mechanism in the different compartments. However, MDI is hydrophobic and poorly soluble in water, and consequently, the heterogeneous reaction with water or soil is less rapid. The major product of such a reaction is solid, insoluble polyurea and this interfacial reaction leads to the formation of a solid crust encasing partially or not reacted product. This crust restricts ingress of water and egress of amine and therefore slows and modifies hydrolysis.

Industrial facilities and settings are fitted with special equipment, ensuring encapsulation of the substance in closed systems under strictly controlled conditions. Thus, rigorous containment by technical means is applied in manufacturing of MDI and transport.

At manufacturing sites for MDI, waste water is subjected to industrial waste water treatment plant with adapted sludge.

As MDI is a reactant with water, access of water to MDI and vice versa is strictly controlled. Furthermore, MDI polymerizes in the presence of water and thus exposure of MDI to sediment is highly likely to be negligible.

MDI is not classified for environmental hazards according to GHS and therefore no labelling for the environment is requested within EU.

Effect Assessment	Result
Aquatic Toxicity	Products of the rapid hydrolysis are not harmful for aquatic organisms

Fate and behaviour	Results
Biodegradation	Due to the reactivity of MDI to water, not possible to determine. For PMDI, an attempt for inherent biodegradation resulted in the conclusion: Not readily biodegradable.
Bioaccumulation potential	No bioaccumulation potential
PBT / vPvB conclusion	not classified as PBT and vPvB.

Human health

The exposure potential to MDI is very low, since manufacturing and transports are restricted to specially dedicated facilities and equipment only.

All equipment for manufacturing, transport and industrial uses are strictly controlled. Professional uses are carefully controlled, since uses (e.g. spray foam and coatings) are limited to specially trained persons with corresponding PPE.

Any person who might potentially come into contact with the substances during maintenance and repair has prohibitively to wear corresponding PPE. In case of any accident, appropriate risk management measures are in place and strictly trained.

Risk Management Recommendations

When using the substances, make sure that there is adequate ventilation of storage and work areas.

Personal Protective Equipment

Respiratory protection:

Respiratory protection in case of gases/vapours/ aerosols are formed.

Combination filter for gases/vapours of organic, inorganic, acid inorganic and alkaline compounds (e.g. EN 14387/140 Type ABEK).

Hand protection:

Chemical resistant protective gloves (EN374)

Suitable materials also with prolonged, direct contact recommended: Protective index 6, corresponding > 480 min of permeation time according to EN 374:

Butyl rubber (butyl) - 0.7 mm coating thickness.

Nitrile rubber (NBR) - 0.4 mm coating thickness or

Chloroprene rubber (CR) – 0.5 mm coating thickness

Unsuitable materials:

Polyvinylchloride (PVC) - 0.7 mm coating thickness

Polyethylene-Laminate (PE laminate) - ca. 0.1 mm coating thickness

Eye protection:

Safety glasses with side-shields (frame goggles) (e.g. EN 166)

Body protection:

Safety shoes (e.g. according to EN 20346)

General safety and hygiene measures:

Do not breathe vapour/spray. With products freshly manufactured from isocyanates body protection and chemical resistant protective gloves is recommended. Wearing of closed work clothing is required additionally to stated personal protection equipment. No eating, drinking, smoking or tobacco use at place of work. Take off immediately all contaminated clothing. Hands and /or face should be washed before breaks and at the end of shift. At the end of the shift the skin should be cleaned and skin-care agents applied.

State Agency Review

Methylenediphenyl diisocyanates have been reviewed in the European Union in the Risk Assessment Report 2005⁶ and have been registered under REACH.

Regulatory Information / Classification and Labelling

Under GHS substances are classified according to their physical, health and environmental hazards. The hazards are communicated via specific labels and the eSDS. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemical in use.

Classification and labelling of the category group of Methylenediphenyldiisocyanates according to CLP / GHS in the EU: (CLP/GHS: Classification, Labelling and Packaging/Global Harmonised System)

Classification:

Acute toxicity - inhalation:	Acute Tox. 4 H332: Harmful if inhaled.
Skin corrosion/irritation	Skin Irrit. 2 H315: Causes skin irritation
Serious eye damage/eye irritation	Eye Irrit. 2 H319: Causes serious eye irritation.
Skin sensitization:	Skin Sens. 1 H317: May cause an allergic skin reaction.
Respiratory sensitization	Resp. Sens. 1 H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Carcinogenicity:	Carc. 2 H351: Suspected of causing cancer
Specific target organ	STOT Single Exp. 3 H335: May cause respiratory irritation.

⁶ European Union Risk Assessment Report on Methylenediphenyl diisocyanate (MDI) , 2005

toxicity – single:	Affected organs: respiratory system
Specific target organ toxicity - repeated:	STOT Rep. Exp. 2 H373: May cause damage to organs. Affected organs: respiratory system
Hazards to the aquatic environment:	not classified

Labelling:

Signal word: Danger

Hazard pictograms:

GHS07: exclamation mark



GHS08: health hazard



Hazard Statements:

H351: Suspected of causing cancer

H332: Harmful if inhaled

H319: Causes serious eye irritation

H335: May cause respiratory irritation

H315: Causes skin irritation

H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.

H317: May cause an allergic skin reaction.

H373: May cause damage to organs through prolonged or repeated exposure;

Additional text: respiratory system - inhalation

Precautionary statements:

- P260: Do not breathe dust/fume/gas/mist/vapour/spray.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P285: In case of inadequate ventilation wear respiratory protection.
- P302+P352: IF ON SKIN: Wash with plenty of soap and water.
- P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P309+P311: IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.
- P403+P233: Store in a well ventilated place. Keep container tightly closed.
- P501: Dispose of contents/container to hazardous or special waste collection point.
- EUH204: Contains isocyanates. May produce an allergic reaction.

Note C:

Some organic substances may be marketed either in a specific isomeric form or as a mixture of several isomers. In this case, the supplier must state on the label, whether the substance is a specific isomer or a mixture of isomers.

Note 2:

The concentration of isocyanate stated is the percentage by weight of the free monomer calculated with reference to the total weight of the mixture.

Concentrations


Calculate ATE (Acute Toxicity Estimate) for mixture	H332, Acute tox cat. 4
10% ≤ C < 25%	H334, Resp. Sens. cat 1 H351, Carc. cat. 2 H317, Skin Sens. cat. 1 H319, Eye Irrit. cat. 2 H315, Skin Irrit. cat. 2 H335, STOT – SE cat. 3 H373, STOT – RE cat. 2
5% ≤ C < 10%	H334, Resp. Sens. cat 1 H351, Carc. cat. 2 H317, Skin Sens. cat. 1 H319, Eye Irrit. cat. 2 H315, Skin Irrit. cat. 2 H335, STOT – SE cat. 3
1% ≤ C < 5%	H334, Resp. Sens. cat 1 H351, Carc. cat. 2 H317, Skin Sens. cat. 1
0.1% ≤ C < 1%	H334, Resp. Sens. cat.1

**Classification and labelling of the category group of
 Methylenediphenyldiisocyanates according to Council Directive 67/548/EEC 31st
 Adaptation**

Indication of danger

Xn; Harmful

Labelling

<p>St Andrew's Cross; Xn</p> 	<p><u>R-phrases:</u></p> <p>R48/20 - harmful: danger of serious damage to health by prolonged exposure through inhalation R40 - limited evidence of a carcinogenic effect R42/43 - may cause sensitisation by inhalation and skin contact R36/37/38 - irritating to eyes, respiratory system and skin R20 - harmful by inhalation</p> <p><u>S-phrases:</u></p> <p>S38 - in case of insufficient ventilation, wear suitable respiratory equipment S1/2 - keep locked up and out of reach of children S23 - do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer) (vapour or spray) S36/37 - wear suitable protective clothing and gloves S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)</p>
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Concentrations

C ≥ 25%	Xn; R20-36/37/38-40-42/43-48/20
10% ≤ C < 25%	Xn; R36/37/38-40-42/43-48/20
5% ≤ C < 10%	Xn; R36/37/38-40-42/43
1% ≤ C < 5%	Xn; R40-42/43
0.1% ≤ C < 1%	Xn; R42

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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

<http://www.icca-chem.org/en/Home/ICCA-initiatives/global-product-strategy/>

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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
Reprotoxicity	combining teratogenicity, embryotoxicity and harmful effects on fertility Sensitising allergenic

Disclaimer:

ISOPA

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