



Hexamethylenediamine

Chemical Identity

Brand names	Rhodiamine HMD	CAS number	124-09-4
Chemical name (IUPAC)	Hexane-1,6-diamine	Molecular formula	C ₆ H ₁₆ N ₂
Synonyms	HMD; HMDA; 1,6-diaminohexane; 1,6-hexanediamine	Molecular weight	116.20 g/mol

Applications

Hexamethylenediamine (HMD) is produced from adiponitrile and is mainly used in the production of polymers especially as a monomer for the synthesis of nylon 6-6. It is used also in a wide range of applications in coatings, lubricants and water treatment products.

Safety Assessment, Exposure and Risk Management Recommendations

Physical and chemical properties

Property	Result
Physical state	Solid at room temperature
Colour	Colourless to white
Odour	Strong, amine odour
Boiling point	201°C at atmospheric pressure
Melting point range	39 – 41°C at atmospheric pressure
Flammability	Non flammable
Water solubility	Readily soluble
Octanol water partition	Low potential for bioaccumulation

Health effects



HMD causes adverse effects to human health by dermal, inhalation and oral routes. Stringent safety measures must be respected for HMD handling. For more details, consult the Safety Data Sheet.

Environmental effects



HMD is harmful to aquatic organisms. It is, however, readily biodegradable, not persistent and has a low potential for bioaccumulation. Industrial sites emissions, disposal, treatment or recycling must comply with applicable regulations to preserve the environment.

Regulatory information and certifications

Classification and labelling



Acute toxicity, Oral, Cat. 4	H302 Harmful if swallowed
Acute toxicity, Dermal, Cat. 4	H312 Harmful in contact with skin
Skin Corrosion, Cat. 1B	H314 Causes severe skin burns and eye damage
STOT, single exposure, Cat. 3	H335 May cause respiratory irritation

Danger

EU regulation (EC) 1272/2008 (CLP)

Registration and certification

ISO 9001: 2008 certified
EU regulation on chemicals (EC) 1907/2006 (REACH)

GPS Safety Summary

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. 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 (extended) Safety Data Sheet (e)SDS for the chemical substance.

Hexamethylenediamine

General Statement

Hexamethylenediamine (HMD) is an organic compound. The colourless solid has a strong amine odour. It is synthesised from adiponitrile.

It is mainly used for the production of polymers and especially as a monomer for the synthesis of nylon 6-6 via condensation with adipic acid. HMD is also used in the chemical industry for a wide range of applications.

The pure substance causes adverse effects to human health, it is corrosive for skin and causes serious eye damage, it may be irritating to the upper respiratory tract and is harmful if swallowed or in contact with skin. It is not classified as dangerous for the environment.

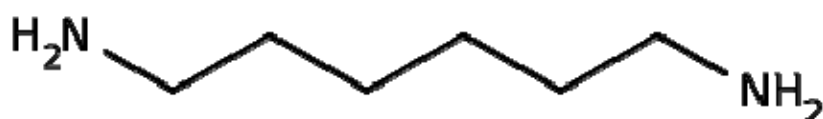
It is handled in industry under stringent safety conditions in accordance with the risk management measures to control the risk of exposure and preserve human health and environment.

Consumer exposure to hexamethylenediamine is not expected.

Chemical Identity

Name:	Hexamethylenediamine
Brand names:	Rhodiumine HMD
Chemical name (IUPAC):	Hexane-1,6-diamine
Synonyms:	HMD; HMDA; 1,6-diaminohexane; 1,6-hexanediamine
CAS number(s):	124-09-4
EC number:	204-679-6
Molecular formula:	C ₆ H ₁₆ N ₂

Structure:



Uses and applications

Hexamethylenediamine is a key intermediate used in industrial yarns, textile, carpet, engineering thermoplastics, resin, and coating applications. It is a precursor to the manufacturing of nylon 6-6 and polyurethanes.

HMD is also used for the formulation of coatings, epoxy curing agents, petroleum additives, adhesives, inks, scale and corrosion inhibitors, and water treatment chemicals.

Hexamethylenediamine is only used for industrial purposes.

Physical/Chemical Properties

Phys/Chem Safety Assessment

Property	Value
Physical state	Solid at 20°C and atmospheric pressure
Form	Crystalline powder
Colour	Colourless to white
Odour	Strong amine odour
Molecular weight	116.20 g/mol
Melting Point range	39 - 41°C at atmospheric pressure
Boiling Point	201°C at atmospheric pressure
Flash point	85°C at atmospheric pressure
Flammability	Non flammable
Explosive properties	Non explosive
Self-ignition temperature	315°C at atmospheric pressure
Vapour pressure	0.27 hPa at 20°C
Water solubility	637 g/l at 20°C, readily soluble
Octanol Water partition coefficient (log Kow)	0.4 at 25°C, low potential for bioaccumulation

Based on available data, hexamethylenediamine is not classified regarding physical and chemical hazards, according to EU regulation (EC) 1272/2008.

Hexamethylenediamine is solid at room temperature; however, for physico-chemical properties relevant for occupational exposure, it has to be considered as a liquid as it is always handled and used in such a state. It is occasionally transported or placed on the market in drums as a mass crystallized solid, but it is always used after melting the product.

Health Effects

Human Health Safety Assessment

Effect Assessment	Result
Acute Toxicity Oral/inhalation/dermal	Harmful if swallowed or in contact with skin. No reliable data available by inhalation. Moreover, since the substance is corrosive, no further tests are required.
Irritation / corrosion Skin/eye/respiratory tract	Causes severe skin burns and eye damage. May cause an irritation of the upper respiratory tract.
Sensitisation	No reliable data available for skin sensitization. Moreover, since the substance is corrosive, no further tests are required.
Toxicity after repeated exposure Oral/inhalation/dermal	May cause an irritation of the upper respiratory tract after repeated exposure.
Genotoxicity / Mutagenicity	Neither mutagenic nor genetic effect, based on <i>in vitro</i> and <i>in vivo</i> tests results
Carcinogenicity	No carcinogenic effects expected. Studies showed neither genotoxicity nor systemic toxicity. In addition, since the substance is classified as corrosive and irritant for respiratory tract, long-term human professional exposure must be minimized.
Toxicity for reproduction	No adverse effect on fertility and on development based on results from a two generation study and a prenatal development study in rats.

All these results are based on available data. Hexamethylenediamine is classified as hazardous for health according to EU regulation (EC) 1272/2008.

Environmental Effects

Environment Safety Assessment

Effect Assessment	Result
Aquatic Toxicity	Harmful to invertebrates Not harmful to fish and algae

Fate and behaviour	Result
Biodegradation	Readily biodegradable
Bioaccumulation potential	Not potentially bioaccumulative (Log Kow = 0.4)
PBT / vPvB conclusion	Not considered to be either PBT nor vPvB

Based on available data, hexamethylenediamine is considered as harmful to aquatic invertebrates, but as it is readily biodegradable and not potentially bioaccumulative, it is not classified as dangerous for the environment according to EU regulation (EC) 1272/2008.

Exposure

Hexamethylenediamine is only used in industry. Considering its industrial lifecycle, from manufacture to its use in chemical synthesis or in preparations, human and environmental exposure have been assessed through exposure scenarios in the REACH dossier.

Pure HMD is a corrosive substance. Frequent and direct contact with the substance must be avoided. Manual phases must be minimized and the substance must be handled under stringent safety conditions in accordance with the risk management measures to control the risk of exposure and to preserve human health and environment.

Human health

On industrial sites, hexamethylenediamine is manufactured and handled as much as possible in closed processes which ensure that the risk is controlled. Where there is a risk of exposure, during (un)loading, mixing, sampling, analysis or maintenance operations, it must be kept as low as possible and at a safe level (strictly below exposure limits, when applied) by the use of appropriate risk management measures as suitable collective and personal protective equipment, good industrial hygiene practices and risk communication through appropriate training of workers.

Environment

Hexamethylenediamine is water soluble and readily biodegradable, it has a low potential for bioaccumulation and for volatilization in the water compartments. Based on its physical and chemical properties, if HMD was released into the environment, it would be mainly distributed in water and would not be persistent.

On the manufacturing site, the risk for the aquatic environment is controlled as effluents that may contain the substance are either directed to an on-site or municipal waste water treatment plant or incinerated on-site in an incinerator allowed to destroy hazardous wastes in compliance with European legislation.

Due to its toxicological and ecotoxicological properties, an indirect risk of human exposure via the environment is not expected for hexamethylenediamine.

Risk Management Recommendations

Hexamethylenediamine is used only in industry; recommendations are based on the risk assessment to preserve human health and environment.

Human health

Workers must be well informed and trained and must refer to the extended Safety Data Sheet (eSDS). In order to control possible risks during the handling of the substance (during (un)loading, mixing, sampling, analysis or maintenance operations), the substance must be contained by technical means. Where this is not possible, handling must be under an effective exhaust ventilation system and appropriate Personal Protective Equipment (PPE) must be worn (safety goggles, gloves, protective suit) as recommended in the eSDS.

In case of risk of exposure to dust, aerosol or vapour of the molten substance, a respirator with approved filter must be worn as the substance may be irritating to the upper respiratory tract.

Hygiene measures must be respected (accessible emergency equipment, well-maintained PPE, wash hands and skin following contact, do not eat, drink or smoke on the workplace).

Environment

All industrial aqueous releases that may contain the substance are controlled in accordance with the risk assessment and must be directed to a waste water treatment plant or incinerated in compliance with local regulation.

Disposal, treatment or recycling of industrial waste must comply with applicable regulations to preserve environment.

State Agency Review

Hexamethylenediamine has been registered under: EU regulation (EC) 1907/2006 (REACH)

Hexamethylenediamine has been reviewed under the following regulatory and/or voluntary programmes: OECD list of High Production Volume chemicals: UNEP publication in 2002

Regulatory Information / Classification and Labelling

Substance classification and labelling according to EU regulation (EC) 1272/2008 (CLP)*:

Classification

Acute toxicity, Oral, Category 4

Acute toxicity, Dermal, Category 4

Skin corrosion, Category 1B

Specific target organ toxicity - single exposure, Category 3

H302 Harmful if swallowed.

H312 Harmful in contact with skin.

H314 Causes severe skin burns and eye damage.

H335 May cause respiratory irritation.

Labelling

Pictogram:



Signal word:

Danger

Hazard statements:

H302 Harmful if swallowed.

H312 Harmful in contact with skin.

H314 Causes severe skin burns and eye damage.

H335 May cause respiratory irritation.

Precautionary statements:

P260 Do not breathe dust/fume/gas/mist/vapours/spray.

P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

P301 + 330 + 331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310 Immediately call a POISON CENTER or doctor/ physician.

*Harmonised EU classification and labelling

Contact information within company

For further information on this substance or Product Safety Summaries in general, please contact:

Rhodia Global Product Strategy: http://www.rhodia.com/en/sustainability/global_product_strategy/index.tcm

Contact: globalproductstrategy@eu.rhodia.com

Additional information

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

(extended) Safety Data Sheet available on demand: http://www.rhodia.com/en/contact/contact_form_business.tcm

Glossary of technical terms: http://www.rhodia.com/en/sustainability/global_product_strategy/glossary/index.tcm

Date of issue: September 2012

Revision: 0

Disclaimer

The information provided in the present Safety Summary is based on European data available in REACH regulatory dossier (EC N°1907/2006) and is correct to the best of our knowledge, information and belief at the date of its publication. Such information is only intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy and is not to be considered as a warranty or quality specification. It does not replace the safety data sheet and technical sheets. Thus, the information provided in this Safety Summary only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in another manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.