Product Safety Summary for HDI-based Polyisocyanates

This Product Safety Summary is intended to provide a general description of certain Covestro chemical products and products containing the chemical substance(s). The information in this Summary is not intended to replace the information included on the Safety Data Sheet (SDS), Product Safety Label, and other safe use and handling literature for the chemical substance(s). Additional information can be found on the Safety Data Sheet (SDS) for each specific product at the Product Safety First website.

Chemical Identity

Chemical Name: Hexamethylene-1,6-diisocyanate (HDI) based polyisocyanates

CAS Number(s): 28182-81-2

Synonym(s): HDI-based polyisocyanates, Desmodur® N

General Product Overview

Polyisocyanates are chemical compounds that contain multiple isocyanate functional groups and are the raw materials or building blocks for a variety of polyurethane coatings, adhesives and sealants. HDI-based polyisocyanates are manufactured from HDI and still contain small residual amounts of this diisocyanate monomer (see also separate Product Safety Summary). Therefore properties of HDI have to be considered here, too.
HDI-based polyisocyanates are reactive chemicals that can irritate the respiratory tract, eyes and skin. With repeated overexposures or a single large overexposure to airborne HDI-based polyisocyanates above the occupational exposure guideline, some individuals may become sensitized and may develop asthma. Specific precautions must be used to minimize exposure and promote safe storage, transport, handling and use of HDI-based polyisocyanates.

Covestro does not market HDI-based polyisocyanates directly for consumer use. Once they have been fully reacted in end-use products, HDI-based polyisocyanates sold by Covestro, when used as intended, are not expected to present an exposure risk to consumers.

**Applications & Uses**

HDI-based polyisocyanates are used by industrial customers as binders or hardeners to manufacture some kinds of coatings, adhesives, or elastomers. These HDI-based polyisocyanates are primarily used in the manufacture of industrial coatings where high performance capability (e.g., UV resistance and weatherability) is a requirement. These HDI-based coatings products are used in the manufacture of various products, including automobiles, airplanes, flooring, furniture, safety equipment, infrastructure, machinery and medical devices, and in after-market coating of automobiles. See more information on industries for which Covestro creates tailored HDI-based polyisocyanates on the Covestro website.

Covestro does not market HDI or HDI-based polyisocyanates for consumer use. Product literature clearly states that these products are not suitable for consumer (i.e., Do It Yourself {DIY}) use.

**Physical and Chemical Properties**

This Product Safety Summary covers a range of HDI-based polyisocyanates that have varying physical properties tailored to customer needs. An example for one HDI-based product is summarized below.

HDI-based polyisocyanates are clear, slightly yellow liquids. HDI-based polyisocyanates are insoluble in water and react with water to form CO₂ gas and an inert solid.
Boiling point: not applicable, decomposition
Flash point: ~174 °C (345 °F)
Vapor pressure: ~ 1.8 X 10^-5 @ 68 F (20 C) mmHg
Partition coefficient: n-octanol/water: logPow: ca. 6.62 (calculated)
Molecular Weight: ~500 g/mol

Additional physical and chemical property information is available for each HDI-based polyisocyanate on the product Safety Data Sheet (SDS).

**Human Health Information**

The potential to experience health effects associated with overexposure to HDI-based polyisocyanates depends on the exposure level and duration and other factors, including individual susceptibility. The potential health effects from overexposure to HDI-based polyisocyanates and residual monomeric HDI are discussed below. Different regulatory classification criteria apply in different geographic regions. Specific regulatory classification information is contained in the Safety Data Sheet for each product in use in each geographic region. The acute and chronic health effects information set forth below is based on Safety Data Sheets in use in the United States.

Please see the Covestro Safety Data Sheet for individual products for specific information on their toxicity.

**Acute Health Effects:**

Isocyanate vapors or mist at concentrations above the exposure limits or guidelines can irritate (burning sensation) the mucous membranes in the respiratory tract (nose, throat, lungs) with symptoms of runny nose, sore throat, coughing, chest discomfort, shortness of breath and reduced lung function (breathing difficulty). Persons with a preexisting, nonspecific bronchial hyperreactivity can respond to concentrations below the exposure limits or guidelines with similar symptoms as well as asthma attack or asthma-like symptoms. Exposure well above the exposure limits or guidelines may lead to bronchitis, bronchial spasm and pulmonary edema (fluid in lungs). Chemical or hypersensitivity pneumonitis, with flu-like symptoms (e.g. fever, chills), has also been reported. These symptoms can be delayed up to several hours after exposure. These effects are usually reversible.

May cause skin irritation with symptoms of reddening, itching, and swelling. Can cause skin sensitization. Persons previously sensitized can experience allergic skin reaction with symptoms of reddening, itching, swelling, and rash. Cured material is difficult to remove.
May cause eye irritation with symptoms of reddening, tearing, stinging, and swelling. May cause temporary corneal injury. Vapor or aerosol may cause irritation with symptoms of burning and tearing.

May cause irritation of the digestive tract; Symptoms may include abdominal pain, nausea, vomiting, and diarrhea.

**Chronic Health Effects:**

As a result of previous repeated overexposures or a single large dose, certain individuals may develop sensitization to isocyanates (asthma or asthma-like symptoms) that may cause them to react to a later exposure to isocyanates at levels well below the exposure limits or guidelines. These symptoms, which can include chest tightness, wheezing, cough, shortness of breath or asthmatic attack, could be immediate or delayed up to several hours after exposure. Extreme asthmatic reactions can be life threatening. Similar to many non-specific asthmatic responses, there are reports that once sensitized an individual can experience these symptoms upon exposure to dust, cold air, or other irritants. This increased lung sensitivity can persist for weeks and in severe cases for several years. Sensitization can be permanent. Chronic overexposure to isocyanates has also been reported to cause lung damage (including fibrosis, decrease in lung function) that may be permanent.

Prolonged skin contact can cause reddening, swelling, rash, and, in some cases, skin sensitization. Animal tests and other research indicate that skin contact with isocyanates can play a role in causing isocyanate sensitization and respiratory reaction. This data reinforces the need to prevent direct skin contact with isocyanates.

Prolonged vapor contact with the eyes may cause conjunctivitis.

HDI-based polyisocyanates are not considered to be mutagenic or genotoxic based on a weight-of-the-evidence assessment. The potential to cause carcinogenic, reproductive/fertility, developmental toxicity/teratogenic or neurological effects has not been observed in animal studies of HDI-based polyisocyanates.

More information can be obtained in the Safety Data Sheet.

**Environmental Information**

**Environmental Fate:**
HDI-based polyisocyanates are manufactured in closed systems. During normal operating conditions, HDI-based polyisocyanates are not expected to be released to the air, soil or water. Procedural and/or control technologies are used to minimize emissions and potential exposure during cleaning and maintenance activities.

If there is an unintentional release of HDI-based polyisocyanates, HDI-based polyisocyanates will react and are not expected to accumulate in the environment. HDI-based polyisocyanates quickly react with water to form CO₂ and a solid material (polyurea), which is insoluble and inert. If HDI-based polyisocyanates release HDI vapor to the air, HDI will degrade in the air (half-life of HDI is 5.6 hr.).

Environmental Toxicity Testing:

Environmental toxicity test data from several aquatic species shows that HDI-based polyisocyanates have low environmental toxicity.

More information can be obtained in the Safety Data Sheet.

Potential Occupational Exposure

HDI-based polyisocyanates are manufactured in closed systems. During normal operating conditions, occupational exposure to HDI-based polyisocyanates is not expected in that manufacturing process. Procedural and/or control technologies are used to minimize exposure during sampling, cleaning, maintenance or upset conditions. In those cases, prescribed personal protective equipment is required.

Industrial and professional applications of HDI-based polyisocyanates may result in potential exposure of workers to the products and to low residual amounts of HDI in those products. Users of those products should conduct air sampling and use appropriate engineering controls (i.e., ventilation) and personal protective equipment according to the exposure guidelines and workplace practices identified in the product Safety Data Sheet. Also see the Covestro Product Safety Summary on HDI.

Potential Consumer Exposure

Covestro does not market HDI-based polyisocyanates directly for consumer use. Once they have been fully reacted in end-use products, HDI-based polyisocyanates sold by Covestro, when used as intended, are not expected to present an exposure risk to consumers.
Safe Use Recommendations/Workplace Exposure Controls

Covestro follows and recommends that customers follow workplace exposure guidelines through a variety of industrial hygiene and ventilation measures. Workplace exposure guidelines include workplace limit values (e.g. the ACGIH Threshold Limit Value-Time Weighted Average (TLV-TWA) (concentration for a conventional 8-hour workday and a 40-hour workweek for a working lifetime without adverse effect) of 0.005 ppm for HDI and any Ceiling Limit (concentration that should not be exceeded during any part of the working exposure) that is set forth in the applicable Safety Data Sheet.

Several validated sampling and analytical methods are available to evaluate potential exposures to airborne HDI and HDI-based polyisocyanates. Further, during certain handling and use conditions with inadequate ventilation, airborne concentrations of HDI or HDI-based polyisocyanates can exceed the appropriate standard/guideline. In these instances, respiratory protection is required. In addition, appropriate skin and eye protective equipment should be worn to prevent contact with HDI and HDI-based polyisocyanates.

Because of the possibility of sensitization, employees who are assigned to an isocyanate work area should undergo a pre-placement medical evaluation and be part of a comprehensive medical surveillance program. Once a worker has been diagnosed as sensitized to any isocyanate, no further isocyanate exposure should be permitted.

Further guidance and information is provided in the Safety Data Sheets available on the Covestro Product Safety First website. Education and training programs and any applicable medical surveillance guidelines are also available on the Product Safety First website.

Product Stewardship information to support our products is available on the Product Safety First website.

See the Safety Data Sheets for HDI and specific HDI-based polyisocyanates for additional information about first aid measures, accidental releases (spills and leaks), waste disposal, toxicity, transportation, regulatory requirements and other important topics.

References

Covestro regional SDSs on the Product Safety First website

Covestro Website: www.covestro.com
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