MATERIAL SAFETY DATA SHEET

DATE: 2012-1-1  SDS NO.: 
NAME: HDI  EDITION: 

Section 1- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Product: Hexamethylene diisocyanate; 1,6-diisocyanatohexane
Product Name: Wannate HDI
Company Identification
Wanhua Chemical Group Co., Ltd.
NO.7 South Xingfu Road, Yantai, Shandong China
Zip code: 264002  Fax: 0535-6875138
For emergencies Tel: +86 535 3388958
+86 532 83889090
Manufacturer: Wanhua Chemical (Ningbo) Co., Ltd
NO.39 Huandao North Road, Daxie Development Zone, Ningbo, Zhejiang, PRC

Section 2  HAZARDS IDENTIFICATION

Important hazards: Toxic by inhalation. Irritating to eyes, respiratory system and skin.
May cause sensitisation by inhalation and skin contact. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

GHS Classification:
Acute Tox: - Category 3 H331,
Eye Irrit. - Category 2 H319,
STOT SE - Category 3 H335,
Skin Irrit. - Category 2 H315,
Resp. Sens. - Category 1 H334,
Skin Sens. - Category 1 H317

Symbols:

Signal Words:
Danger

Hazard Statements: The product is toxic by inhalation. It severely irritates the skin and may cause reddening, swelling, inflammation and rashes. The vapors irritate the mucous membranes of the eyes and the respiratory tract, causing watering of the eyes and coughing. Lasting damage to the eyes is possible. Skin contact and possibly also inhalation may cause sensitization.

Precautionary Statements:
Prevention: Avoid breathing dust/gas/fumes/vapor/spray. Only operate in outdoors or well ventilated place after given specific guidance. Don’t use before reading and understanding all safety precautions. Use individual protective equipments as required. Avoid contacting with eyes, skin. Clean thoroughly after operation.

WANHUA CHEMICAL GROUP CO., LTD
Response: If inhaled, transfer the patients to fresh air place and keep the body position good for breathing and call poison control center or doctor immediately. If contact or anxious, go to hospital. Skin contact: wash with plenty of soap and water. If skin irritation or rash appear: go to a doctor. Remove contaminated clothing and can be used again after washing. If contact with eyes: carefully rinse with water for a few minutes. Take out contact lenses and continuous wash. If eyes irritation last: go to a doctor.

Storage: Store in a cool, dry and well ventilated warehouse. Keep away from fire and heat source. Keep container sealed. Store separately from oxidant, acid, alkali, alcohol and food chemicals. Equipped with corresponding varieties and number of fire equipment. Storage area should be equipped with emergency treatment equipment and appropriate containers for absorbing leakage.

Disposal: The storage of barrels with residual material should be avoided from water for preventing burst. Without free-pollution disposal, barrels shall not be stored food and other materials, so as to cause harmful to human body and environment. Recycling, utilization and disposal of packaging should be complying with national and local relevant laws and regulations. Harm and loss caused by improper disposal of packaging material, the disposal party should take responsibility.

Important symptoms:  

<table>
<thead>
<tr>
<th>NFPA rating:</th>
<th>Flammable=1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Health=4</td>
</tr>
<tr>
<td></td>
<td>Reactivity=1</td>
</tr>
</tbody>
</table>

HAZARD TO HUMANS AND THE ENVIRONMENT
Hazard by inhalation, eye contact and ingestion. Irritating to eyes, respiratory system and skin. May cause sensitization by inhalation and skin contact.

<table>
<thead>
<tr>
<th>Substance/mixture</th>
<th>Substance</th>
<th>CAS RN</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME</td>
<td>Hexamethylene diisocyanate</td>
<td>822-06-0</td>
<td>99.5%min</td>
</tr>
</tbody>
</table>

Section 4-FIRST AID MEASURES
INHALATION: If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

SKIN CONTACT: In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE CONTACT: In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.
**INGESTION:** If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

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**Section 5 - FIRE FIGHTING MEASURES**

**EXTINGUISHING MEDIA**
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

**SPECIAL RISKS**
Specific Hazard(s): Emits toxic fumes under fire conditions.

**SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS**
Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

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**Section 6 - ACCIDENTAL RELEASE MEASURES**

**PERSONAL PRECAUTION PROCEDURES TO BE FOLLOWED IN CASE OF LEAK OR SPILL**
Evacuate area.

**PROCEDURE(S) OF PERSONAL PRECAUTION(S)**
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

**METHODS FOR CLEANING UP**
Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

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**Section 7 - HANDLING AND STORAGE**

**HANDLING**
Directions for Safe Handling: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

**STORAGE**
Conditions of Storage: Keep tightly closed containers. Precautions must be taken to avoid contamination by moisture and air. Processability of this material can be adversely affected by contamination. Water or moisture in the air reacts with the product to generate pressure.

**SPECIAL REQUIREMENTS**
Moisture sensitive.

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**Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

Hexamethylene-1,6-Diisocyanate (822-06-0)

**US. ACGIH Threshold Limit Values**
Time Weighted Average (TWA): 0.005 ppm

**Germany Exposure Limit**
Ceiling Limit Value: 0.02 ppm

**Industrial Hygiene/Ventilation Measures**
Local exhaust should be used to maintain levels below the exposure limits or guidelines whenever diisocyanate is handled, processed, or spray-applied. At normal room temperature (70 °F) HDI levels quickly exceed the exposure limits or guidelines.
unless properly ventilated. Standard reference sources regarding industrial ventilation should be consulted for guidance about adequate ventilation. To ensure that exposure limits or guidelines have not been exceeded, monitoring for airborne diisocyanates should become part of the overall employee exposure characterization program. NIOSH, OSHA and others have developed sampling and analytical methods.

**Respiratory Protection**
At normal room temperatures, airborne HDI can exceed the appropriate standard/guideline; therefore, in inadequately ventilated environments respiratory protection must be worn. The type of respiratory protection selected must comply with the requirements set forth in OSHA’s Respiratory Protection Standard (29 CFR 1910.134). The type of respiratory protection available includes (1) an atmosphere-supplying respirator such as a self-contained breathing apparatus (SCBA) or a supplied air respirator (SAR) in the positive pressure or continuous flow mode, or (2) an air-purifying respirator (APR). If an APR is selected, the following conditions must be met: (1) (a) the cartridge must be equipped with an end-of-service life indicator (ESLI) certified by NIOSH, or (1) (b) a change out schedule, based on objective information or data that will ensure that the cartridges are changed out before the end of their service life, must be developed and implemented. The basis for the change out schedule must be described in the written respirator program. (2) the airborne HDI concentration must be no greater than 10 times the appropriate standard/guideline.

**Hand Protection**
Gloves should be worn. Nitrile rubber showed excellent resistance. Butyl rubber, neoprene, and PVC are also effective.

**Eye Protection**
When directly handling liquid product, eye protection is required. Examples of eye protection include a chemical safety goggle, or chemical safety goggle in combination with a full face shield when there is a greater risk of splash.

**Skin and body protection**
Avoid all skin contact. Depending on the conditions of use, cover as much of the exposed skin area as possible with appropriate clothing to prevent skin contact.

**Medical Surveillance**
All applicants who are assigned to an isocyanate work area should undergo a pre-placement medical evaluation.

**Additional Protective Measures**
Emergency showers and eye wash stations should be available. Educate and train employees in the safe use and handling of this product. Follow all label instructions.

### Section 9- PHYSICAL AND CHEMICAL PROPERTIES
<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colorless clear liquid</td>
</tr>
<tr>
<td>Odour Bulk</td>
<td>Pungent, tear exciting</td>
</tr>
<tr>
<td>Density at 25 °C</td>
<td>1050 kg/m³</td>
</tr>
<tr>
<td>Specific heat at 20 °C</td>
<td>1.76 kJ/kg</td>
</tr>
<tr>
<td>Temperature of crystallization</td>
<td>-67 °C</td>
</tr>
<tr>
<td>Boiling point under 1.33 kPa</td>
<td>122 °C</td>
</tr>
</tbody>
</table>
**Boiling point under 1013 hPa**: 261 °C
**Vapor pressure at 20 °C**: 2.2*10^-3 mbar (0.22 Pa)
**Vapor pressure at 30 °C**: 7.2*10^-3 mbar (0.72 Pa)
**Self-ignition temperature**: 454 °C
**Flash point (closed cup)**: 140 °C approx.
**Vapor density (air = 1)**: 6
**Concentration of saturated vapor at 20 °C**: 46 mg/m³
**Concentration of saturated vapor at 30 °C**: 137 mg/m³

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**Section 10- CHEMICAL STABILITY AND REACTIVITY INFORMATION**

**Hazardous Reactions**
Contact with moisture, other materials that react with isocyanates, or temperatures above 350 °F (177 °C), may cause polymerization.

**Materials to avoid**
Water, Amines, Strong bases, Alcohols, copper alloys

**Hazardous decomposition products**
By Fire and High Heat: Carbon dioxide (CO₂), carbon monoxide (CO), oxides of nitrogen (NOₓ), dense black smoke, Hydrogen cyanide, Isocyanate, Isocyanic Acid, Other undetermined compounds

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**Section 11 - TOXICOLOGICAL INFORMATION**

**Toxicity Data for Hexamethylene-1,6-Diisocyanate**

**Acute Oral Toxicity**
LD₅₀: 746 mg/kg (Rat)

**Acute Inhalation Toxicity**
LC₅₀: 120 - 350 mg/m³, vapor, 4 hrs (rat)
LC₅₀: 290 mg/m³, 1 hrs (rat)
RD₅₀: 0.35 ppm, (mouse)

**Acute dermal toxicity**
LD₅₀: 570 mg/kg (rabbit)

**Skin Irritation**
Rabbit, Severely irritating

**Eye Irritation**
Rabbit, Severely irritating

**Sensitization**
Dermal: sensitizer (guinea pig, Maximisation Test (GPMT))
Other isocyanates have been shown to produce dermal and respiratory sensitization in several species (guinea pigs, mice, rabbits, dogs). In addition, there is some evidence to suggest that cross-sensitization between different types of diisocyanates may occur.

**Repeated Dose Toxicity**
13 weeks, Inhalation: NOAEL: < 0.01 ppm (0.07 mg/m³), LOAEL: 0.01 ppm (0.07 mg/m³), (Rat, Male/Female, 6 hrs/day 5 days/week)
Irritation to lungs and nasal cavity.
2 years, inhalation: NOAEL: < 0.005 ppm, LOAEL: 0.005 ppm, (rat, Male/Female, 6 hrs/day 5 days/week)
Irritation to lungs and nasal cavity.

**Mutagenicity**
Genetic Toxicity in Vitro:
Ames: negative (Salmonella typhimurium, Metabolic Activation: with/without)
HGPRT Assay: negative (Chinese hamster ovary (CHO) cells, Metabolic Activation: with/without)

Genetic Toxicity in Vivo:
Micronucleus Assay: negative (mouse)

**Carcinogenicity**
Rat, Male/Female, inhalation, 2 yrs, 6 hrs/day 5 days/week
Did not show carcinogenic effects in animal experiments.

**Toxicity to Reproduction/Fertility**
One generation study, inhalation, daily, (rat, Male/Female) NOAEL (parental): < 0.3 ppm, NOAEL (F2): 0.3 ppm
No effects on Reproductive parameters observed at doses tested.

**Developmental Toxicity/Teratogenicity**
Rat, female, inhalation, gestation days 0 - 19, daily, NOAEL (teratogenicity): > 0.3 ppm, NOAEL (maternal): < 0.3 ppm
No Teratogenic effects observed at doses tested. No fetotoxicity observed at doses tested.

**Neurological Effects**
Rats exposed by inhalation, 6 hours/day, for approximately 3 weeks, to concentrations as high as 0.3 ppm showed no neurobehavioral effects or damage to nerve tissues.

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**Section 12–ECOLOGICAL INFORMATION**

**Ecological Data for Hexamethylene-1,6-Diisocyanate**

**Biodegradation**
Aerobic, 42%, Exposure time: 28 Days, Not readily biodegradable.

**Acute and Prolonged Toxicity to Fish**
LC\(_0\): > 82.8 mg/l (Zebra fish (Brachydanio rerio), 96 hrs)

**Acute Toxicity to Aquatic Invertebrates**
EC\(_0\): > 89.1 mg/l (Water flea (Daphnia magna), 48 hrs)

**Toxicity to Aquatic Plants**
EC\(_{50}\): > 77.4 mg/l, (Green algae (Scenedesmus subspicatus), 72 hrs)

**Toxicity to Microorganisms**
EC\(_{50}\): 84.2 mg/l, (Activated sludge microorganisms)

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**Section 13- DISPOSAL CONSIDERATIONS**

**Waste Disposal Method**
Waste disposal should be in accordance with existing federal, state and local environmental control laws.
Incineration is the preferred method.
Empty Container Precautions
Empty containers retain product residue; observe all precautions for product. Do not heat or cut empty container with electric or gas torch because highly toxic vapors and gases are formed. Do not reuse without thorough commercial cleaning and reconditioning. If container is to be disposed, ensure all product residues are removed prior to disposal.

Section 14- TRANSPORTATION INFORMATION

Land transport (DOT)
Proper Shipping Name: Hexamethylene diisocyanate
Hazard Class or Division: 6.1
UN/NA Number: UN2281
Packaging Group: II
Hazard Label(s): Toxic

RSPA/DOT Regulated Components:
Hexamethylene-1,6-Diisocyanate

Sea transport (IMDG)
Proper Shipping Name: HEXAMETHYLENE DIISOCYANATE
Hazard Class or Division: 6.1
UN-No: UN2281
Packaging Group: II
Hazard Label(s): Toxic

Air transport (ICAO/IATA)
Proper Shipping Name: Hexamethylene diisocyanate
Hazard Class or Division: 6.1
UN-No: UN2281
Packaging Group: II
Hazard Label(s): Toxic

Section 15-REGULATORY INFORMATION

United States Federal Regulations
OSHA Hazcom Standard Rating: Hazardous
US. Toxic Substances Control Act: Listed on the TSCA Inventory.
US. EPA CERCLA Hazardous Substances (40 CFR 302):

Components
Hexamethylene-1,6-Diisocyanate Reportable quantity: 100 lbs
SARA Section 311/312 Hazard Categories:
Acute Health Hazard, Chronic Health Hazard
US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III
Section 302 Extremely Hazardous Substance (40 CFR 355, Appendix A):

Components
None
US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA
Title III
Section 313 Toxic Chemicals (40 CFR 372.65) - Supplier Notification Required:

**Components**
Hexamethylene-1,6-Diisocyanate

If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste. (40 CFR 261.20-24)

**State Right-To-Know Information**
The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.

**Massachusetts, New Jersey or Pennsylvania Right to Know Substance Lists:**

<table>
<thead>
<tr>
<th>Weight %</th>
<th>Components</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>Hexamethylene-1,6-Diisocyanate</td>
<td>822-06-0</td>
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</table>

New Jersey Environmental Hazardous Substances List and/or New Jersey RTK Special Hazardous Substances Lists:

<table>
<thead>
<tr>
<th>Weight %</th>
<th>Components</th>
<th>CAS No.</th>
</tr>
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<tbody>
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<td>100%</td>
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</table>

California Prop. 65:
To the best of our knowledge, this product does not contain any of the listed chemicals, which the state of California has found to cause cancer, birth defects or other reproductive harm.

**Section 16-OTHER INFORMATION**

**Disclaimer:**
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. Wanhua Chemical shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

Completed on: 10/01/2009
Revised on:
Completed by: National Registration Center for Chemical, SAWS, China
Audit by: Wanhua Chemical Group Co., Ltd