SAFETY DATA SHEET

WANAMINE™ MDA-100

WANHUA CHEMICAL GROUP Co., LTD.

Version No: 2.3
Safety Data Sheet Safety Data Sheet - Authored according to GB/T16483(2008) and GB/T17519(2013)

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Chemwatch Hazard Alert Code: 4

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

<table>
<thead>
<tr>
<th>Product name</th>
<th>WANAMINE™ MDA-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Name</td>
<td>4,4'-methyleneedianiline</td>
</tr>
<tr>
<td>Chemical English Name</td>
<td>4,4'-methyleneedianiline</td>
</tr>
<tr>
<td>Synonyms</td>
<td>4,4'-METHYLENE DIANILINE</td>
</tr>
<tr>
<td>Proper shipping name</td>
<td>4,4'-DIAMINODIPHENYL- METHANE</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses
Be widely used in epoxy resin hardener, polyamide resin, polyurethane rubber.

Details of the supplier of the safety data sheet

Registered company name
WANHUA CHEMICAL GROUP Co., LTD.

Address
No.17 Tianshan Road, Yantai, Shandong,

Telephone
0535-3031150

Fax
0535-338222-1150

Website
https://www.whchem.com

Email
whsds@whchem.com

Emergency telephone number

Association / Organisation
Not Available

Emergency telephone numbers
+86 532-8389090

Other emergency telephone numbers
+86 535-8203123

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

SUMMARY OF HAZARD IN AN EMERGENCY SITUATION

Toxic if swallowed.

Toxic: Danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

May cause SENSITISATION by skin contact.

Possible risk of irreversible effects.

May cause CANCER.

Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.

Use appropriate container to avoid environmental contamination.

Avoid release to the environment. Refer to special instructions/Safety data sheets.

<table>
<thead>
<tr>
<th>Classification [1]</th>
<th>Acute Toxicity (Oral) Category 3, Skin Sensitizer Category 1, Germ cell mutagenicity Category 2, Carcinogenicity Category 1B, Specific target organ toxicity - single exposure Category 1, Specific target organ toxicity - repeated exposure Category 2, Acute Aquatic Hazard Category 1, Chronic Aquatic Hazard Category 1</th>
</tr>
</thead>
</table>

Legend:

Label elements
Hazard pictogram(s)

SIGNAL WORD DANGER

Hazard statement(s)

H301 Toxic if swallowed.
H317 May cause an allergic skin reaction.
H341 Suspected of causing genetic defects.
H350 May cause cancer.
H370 Causes damage to organs.
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P201 Obtain special instructions before use.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P273 Avoid release to the environment.
P272 Contaminated work clothing should not be allowed out of the workplace.

Precautionary statement(s) Response

P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician/first aider.
P305+P311 IF exposed or concerned: Call a POISON CENTER/doctor/physician/first aider.
P330 Rinse mouth.
P302+P355 IF ON SKIN: Wash with plenty of water and soap.
P314 Get medical advice/attention if you feel unwell.
P335+P313 IF skin irritation or rash occurs: Get medical advice/attention.
P362+P364 Take off contaminated clothing and wash it before reuse.
P391 Collect spillage.

Precautionary statement(s) Storage

P405 Store locked up.

Precautionary statement(s) Disposal

P501 Dispose of contents/container in accordance with local regulations.

Physical and Chemical Hazard

Toxic smoke/fumes in a fire. In case of fire and/or explosion, DO NOT BREATHE FUMES.

Health Hazards

Inhaled

Strong evidence exists that exposure to the material may produce very serious irreversible damage (other than carcinogenesis, mutagenesis and teratogenesis) following a single exposure by inhalation.

The material is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.

Ingestion

Toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual.

The substance and/or its metabolites may bind to haemoglobin inhibiting normal uptake of oxygen. This condition, known as “methaemoglobinemia”, is a form of oxygen starvation (anoxia).

Symptoms include cyanosis (a bluish discolouration skin and mucous membranes) and breathing difficulties. Symptoms may not be evident until several hours after exposure.

At about 15% concentration of blood methaemoglobin there is observable cyanosis of the lips, nose and earlobes. Symptoms may be absent although euphoria, flushed face and headache are commonly experienced. At 25-40%, cyanosis is marked but little disability occurs other than that produced on physical exertion. At 40-60%, symptoms include weakness, dizziness, lightheadedness, increasingly severe headache, ataxia, rapid shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy and stupor. Above 60% symptoms include dyspnea, respiratory depression, tachycardia or bradycardia, and convulsions. Levels exceeding 70% may be fatal.

Skin Contact

Skin contact is not thought to produce harmful health effects (as classified under EC Directives using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions. Good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.

Open cuts, abraded or irritated skin should not be exposed to this material.

Continued...
Continued...

Environmental Hazards
See Section 12

Other hazards
Inhalation may produce heath damage*.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances
See section below for composition of Mixtures

Mixtures

<table>
<thead>
<tr>
<th>CAS No</th>
<th>%[weight]</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-77-9</td>
<td>≥99</td>
<td>4,4'-methylenedianiline</td>
</tr>
</tbody>
</table>

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye
- Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).
- Repeated or long-term occupational exposure is likely to produce cumulative health effects involving organs or biochemical systems. Strong evidence exists that the substance may cause irreversible but non-lethal mutagenic effects following a single exposure. Practical experience shows that skin contact with the material is capable either of inducing a sensitisation reaction in a substantial number of individuals, and/or of producing a positive response in experimental animals.
- On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of:
  - appropriate long-term animal studies
  - other relevant information

Skin Contact
- Exposure to the material may result in a possible risk of irreversible effects. The material may produce mutagenic effects in man. This concern is raised, generally, on the basis of appropriate studies using mammalian somatic cells in vivo. Such findings are often supported by positive results from in vitro mutagenicity studies.
- Most arylamines are powerful haemopoietic poisons producing methaemoglobinemia in humans. Addition of alkyl groups may modify the toxic responses but nevertheless these remains similar to the parent compound. High chronic doses cause splenic congestion and in turn sarcoma formation. Single ring aromatic amines are relatively weak carcinogens requiring large doses to produce any effect in animal experiments. The polycyclic aromatic amines exhibit a wide range of carcinogenic activity which appear, in part, to be dependent on the position on which benzene rings are substituted and the nature of the substituent.
- Most monocylic arylamines produce haemosiderosis (deposition of iron-containing proteins in tissues and organs). It is not clear whether the genotoxic and acute toxic effects are influenced by the release of iron during methaemoglobin formation or erythrocyte turnover and by the "oxidative stress" associated with these processes. In any case, toxic tissue changes and fibrosis precede tumour development in the spleen, liver and kidneys.
- Metabolism of arylamines generally proceeds through N-oxidation, hydroxylation of aromatic ring carbons, and formation of conjugates such as glucuronides, sulfates, and acetates. Ring alkyl substituents may also be oxidised to alcohols and further metabolised to acids. N-oxidation is an important step that can lead to the formation of metabolites that will react with cellular macromolecules. The N-phenylhydroxylamines and nitrosobenzences produced by N-oxidation are capable of binding to the haeme ion in haemoglobin and causing oxidation. This reaction can produce the methaemoglobinemia that is the most typical toxicity associated with aromatic amines.
- Metabolites of aromatic amines, especially those which have undergone N-hydroxylation appear to be the active principle in the development of bladder cancers. Induced methaemoglobinemia may be an indicator of the formation of an N-hydroxylated metabolite. Formation of N-hydroxylated metabolites and conjugates thereof is considered to be an important step in the mechanism of activation for various carcinogenic aromatic amines.
- Due to methaemoglobin forming activity aromatic amines can exert developmental toxicity at least as a secondary consequence of maternal toxicity.
- N-oxidation leading to the formation of N-hydroxyarylamines (see above) can further produce reactive nitrosamines ultimately leading to the formation of reactive arylhydrazinium ions. These in turn may react with skin proteins to produce sensitising effects (as haptens).

Inhalation
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.
- Generally not applicable.

Ingestion
- If SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- For advice, contact a Poisons Information Centre or a doctor.
- Urgent hospital treatment is likely to be needed.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the SDS should be
provided. Further action will be the responsibility of the medical specialist. 

If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the SDS.

Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

- **INDUCE vomit** with fingers down the back of the throat, **ONLY IF CONSCIOUS**. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

**NOTE:** Wear a protective glove when inducing vomiting by mechanical means.

- Generally not applicable.

**Advise for rescue team (PPE requirement for rescue personnel)**

**Indication of any immediate medical attention and special treatment needed**

The material may induce methaemoglobinaemia following exposure.

- Initial attention should be directed at oxygen delivery and assisted ventilation if necessary. Hyperbaric oxygen has not demonstrated substantial benefits.
- Hypotension should respond to Trendelenburg’s position and intravenous fluids; otherwise dopamine may be needed.
- Symptomatic patients with methaemoglobin levels over 30% should receive methylene blue. (Cyanosis, alone, is not an indication for treatment). The usual dose is 1-2 mg/kg of a 1% solution (10 mg/ml) IV over 50 minutes; repeat, using the same dose, if symptoms of hypoxia fail to subside within 1 hour.
- Thorough cleansing of the entire contaminated area of the body, including the scalp and nails, is of utmost importance.

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Index</th>
<th>Sampling Time</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Methaemoglobin in blood</td>
<td>1.5% of haemoglobin</td>
<td>During or end of shift</td>
<td>B, NS, SQ</td>
</tr>
</tbody>
</table>

- **B:** Background levels occur in specimens collected from subjects NOT exposed
- **NS:** Non-specific determinant; also observed after exposure to other materials
- **SQ:** Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

**SECTION 5 FIREFIGHTING MEASURES**

**Extinguishing media**

- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

**Special hazards arising from the substrate or mixture**

| Fire Incompatibility | Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result |

**Advice for firefighters**

<table>
<thead>
<tr>
<th>Fire Fighting</th>
<th>Alert Fire Brigade and tell them location and nature of hazard.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wear breathing apparatus plus protective gloves in the event of a fire.</td>
</tr>
<tr>
<td></td>
<td>Prevent, by any means available, spillage from entering drains or water courses.</td>
</tr>
<tr>
<td></td>
<td>Use fire fighting procedures suitable for surrounding area.</td>
</tr>
<tr>
<td></td>
<td><strong>DO NOT</strong> approach containers suspected to be hot.</td>
</tr>
<tr>
<td></td>
<td>Cool fire exposed containers with water spray from a protected location.</td>
</tr>
<tr>
<td></td>
<td><strong>If safe to do so,</strong> remove containers from path of fire.</td>
</tr>
<tr>
<td></td>
<td>Equipment should be thoroughly decontaminated after use.</td>
</tr>
<tr>
<td></td>
<td>Slight hazard when exposed to heat, flame and oxidisers.</td>
</tr>
</tbody>
</table>

| Fire/Explosion Hazard | Combustible. Will burn if ignited. |
|-----------------------| Combustion products include: |
|                       | carbon monoxide (CO) |
|                       | carbon dioxide (CO₂) |
|                       | nitrogen oxides (NOₓ) |
|                       | other pyrolysis products typical of burning organic material. |
|                       | May emit poisonous fumes. |
|                       | Articles and manufactured articles may constitute a fire hazard where polymers form their outer layers or where combustible packaging remains in place. |
|                       | Certain substances, found throughout their construction, may degrade or become volatile when heated to high temperatures. This may create a secondary hazard. |

**SECTION 6 ACCIDENTAL RELEASE MEASURES**

**Personal precautions, protective equipment and emergency procedures**

See section 8

**Measures for Preventing Secondary Contamination**

Refer to section above

**Environmental precautions**

See section 12

**Methods and material for containment and cleaning up**

<table>
<thead>
<tr>
<th>Minor Spills</th>
<th>Clean up all spills immediately.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secure load if safe to do so.</td>
</tr>
<tr>
<td></td>
<td>Bundle/collection recoverable product.</td>
</tr>
<tr>
<td></td>
<td>Collect remaining material in containers with covers for disposal.</td>
</tr>
</tbody>
</table>
## SECTION 7 HANDLING AND STORAGE

### Precautions for safe handling

#### Safe handling

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

**DO NOT** enter confined spaces until atmosphere has been checked.

**DO NOT** allow material to contact humans, exposed food or food utensils.

- Avoid contact with incompatible materials.
- **When handling,** **DO NOT** eat, drink or smoke.

- Keep containers securely sealed.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.

- Use good occupational work practice.
- Observe manufacturer's storage and handling recommendations contained within this SDS.

- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

#### Other information

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storage and handling recommendations contained within this SDS.
- Store away from incompatible materials.

### Conditions for safe storage, including any incompatibilities

#### Suitable container

- Generally packaging as originally supplied with the article or manufactured item is sufficient to protect against physical hazards.
- If repackaging is required ensure the article is intact and does not show signs of wear. As far as is practicably possible, reuse the original packaging or something providing a similar level of protection to both the article and the handler.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.
- For materials with a viscosity of at least 2680 cSt, (23 deg. C) and solids (between 15 C deg. and 40 deg C.):
  - Removable head packaging;
  - Cans with friction closures and
  - low pressure tubes and cartridges may be used.

Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages *.

In addition, where inner packagings are glass and contain liquids of packing group I and II there must be sufficient inert absorbent to absorb any spillage *.

* unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.

No restriction on the type of containers. Packing as recommended by manufacturer. Check all material is clearly labelled.

#### Storage incompatibility

- Many arylamines (aromatic amines such as aniline, N-ethylaniline, o-toluidine, xylidine etc. and their mixtures) are hypergolic (ignite spontaneously) with red fuming nitric acid. When the amines are dissolved in triethylamine, ignition occurs at -60 deg. C. or less.

- Various metal oxides and their salts may promote ignition of amine-red fuming nitric acid systems. Soluble materials such as copper(II) oxide, ammonium metavanadate are effective; insoluble materials such as copper(II) oxide, iron(II) oxide, potassium dichromate are also effective.

- Avoid oxidising agents, acids, acid chlorides, acid arylhydrides, chloroformates.

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Personal Protective Equipment advice is contained in Section 8 of the SDS.
Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Not Available

EMERGENCY LIMITS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Material name</th>
<th>TEEL-1</th>
<th>TEEL-2</th>
<th>TEEL-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,4'-methyleneedianiline</td>
<td>Methyleneedianiline, 4,4’-</td>
<td>0.1 ppm</td>
<td>3.4 ppm</td>
<td>20 ppm</td>
</tr>
</tbody>
</table>

MATERIAL DATA

Exposure controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:

- Process controls which involve changing the way a job activity or process is done to reduce the risk.
- Enclosure and/or isolation of emission source which keeps a selected hazard “physically” away from the worker and ventilation that strategically “adds” and “removes” air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.

Employers may need to use multiple types of controls to prevent employee overexposure.

Appropriate engineering controls

- Employees exposed to confirmed human carcinogens should be authorized to do so by the employer, and work in a regulated area.
- Work should be undertaken in an isolated system such as a “glove-box”. Employees should wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.
- Within regulated areas, the carcinogen should be stored in sealed containers, or enclosed in a closed system, including piping systems, with any sample ports or openings closed while the carcinogen are contained within.
- Open-vessel systems are prohibited.
- Each operation should be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation.
- Exhaust air should not be discharged to regulated areas, non-regulated areas or the external environment unless decontaminated. Clean make-up air should be introduced in sufficient volume to maintain correct operation of the local exhaust system.
- For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood.
- Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood.
- Except for outdoor systems, regulated areas should be maintained under negative pressure (with respect to non-regulated areas).
- Local exhaust ventilation requires make-up air be supplied in equal volumes to replaced air.
- Laboratory hoods must be designed and maintained so as to draw air inward at an average linear face velosity of 0.76 m/sec with a minimum of 0.64 m/sec. Open-vessel systems are prohibited.

Personal protection

No special equipment required due to the physical form of the product.

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsortion for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

Eye and face protection

Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. A respirator affording higher levels of protection may be substituted. [AS/NZS 1715 or national equivalent]

Skin protection

See Hand protection below

Hands/feet protection

- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.

Body protection

- Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent]
- Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. A respirator affording higher levels of protection may be substituted. [AS/NZS 1715 or national equivalent]
- Emergency deluge showers and eyewash fountains, supplied with potable water, should be located near, within sight of, and on the same level with locations where direct exposure is likely.
- Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood.
- Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood. No special equipment required due to the physical form of the product.

Other protection

- Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent]
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- Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood. No special equipment required due to the physical form of the product.

Thermal hazards

Not Available

NOTES:

- Prior to removing protective garments the employees should undergo decontamination and be required to shower upon removal of the garments and hood.
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Respiratory protection

Respiratory protection not normally required due to the physical form of the product.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White or Pale yellow crystals</td>
</tr>
<tr>
<td>Physical state</td>
<td>solid</td>
</tr>
<tr>
<td>Odour</td>
<td>Not Available</td>
</tr>
<tr>
<td>Odour threshold</td>
<td>Not Available</td>
</tr>
<tr>
<td>pH (as supplied)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Melting point / freezing point (°C)</td>
<td>88-94</td>
</tr>
<tr>
<td>Initial boiling point and boiling range (°C)</td>
<td>398-399</td>
</tr>
<tr>
<td>Flash point (°C)</td>
<td>221</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not Available</td>
</tr>
<tr>
<td>Flammability</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Vapour pressure (kPa)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Solubility in water (g/L)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Vapour density (Air = 1)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Partition coefficient n-octanol / water</td>
<td>Not Available</td>
</tr>
<tr>
<td>Auto-ignition temperature (°C)</td>
<td>261</td>
</tr>
<tr>
<td>Molecular weight (g/mol)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Taste</td>
<td>Not Available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>Not Available</td>
</tr>
<tr>
<td>Oxidising properties</td>
<td>Not Available</td>
</tr>
<tr>
<td>Surface Tension (dyn/cm or mN/m)</td>
<td>Not Available</td>
</tr>
<tr>
<td>pH as a solution (%vol)</td>
<td>Not Available</td>
</tr>
<tr>
<td>VOC g/L</td>
<td>Not Available</td>
</tr>
<tr>
<td>Gas group</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

SECTION 10 STABILITY AND REACTIVITY

Reactivity

See section 7

Chemical stability

- Unstable in the presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

Possibility of hazardous reactions

See section 7

Conditions to avoid

See section 7

Incompatible materials

See section 7

Hazardous decomposition products

See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

**WANAMINE™ MDA-100**

<table>
<thead>
<tr>
<th>Property</th>
<th>Toxicity</th>
<th>Irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>Not Available</td>
<td></td>
</tr>
</tbody>
</table>

**4,4'-METHYLENEDIAMINE**

<table>
<thead>
<tr>
<th>Property</th>
<th>Toxicity</th>
<th>Irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermal (rabbit) LD50: 200 mg/kg</td>
<td>Eye (rabbit): 100 mg/24h - moderate</td>
<td></td>
</tr>
<tr>
<td>Oral (rat) LD50: 100 mg/kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:

1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer’s SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances

**4,4'-METHYLENEDIAMINE**

Oral (rat) LD50: 400-500 mg/kg [BASF]
The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling of the epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

**WARNING:** This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

**WANAMINE™ MDA-100 & 4,4'-METHYLENEDIAMINE**

The following information refers to contact allergens as a group and may not be specific to this product.
Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger...
### SECTION 12 ECOLOGICAL INFORMATION

#### Toxicity

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>endpoint</th>
<th>test duration (hr)</th>
<th>species</th>
<th>value</th>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,4'-methylenedianiline</td>
<td>LC50</td>
<td>96</td>
<td>fish</td>
<td>18mg/L</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>EC50</td>
<td>48</td>
<td>crustacea</td>
<td>0.35mg/L</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EC50</td>
<td>72</td>
<td>algae or other aquatic plants</td>
<td>21mg/L</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NOEC</td>
<td>504</td>
<td>crustacea</td>
<td>0.00525mg/L</td>
<td>2</td>
</tr>
</tbody>
</table>

- **Legend:**
  - Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data

#### Persistence and degradability

- **Ingredient:** 4,4'-methylenedianiline
  - Persistence: Water/Soil: LOW (Half-life = 14 days)
  - Persistence: Air: LOW (Half-life = 0.11 days)

#### Bioaccumulative potential

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>bioaccumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,4'-methylenedianiline</td>
<td>LOW (BCF = 15)</td>
</tr>
</tbody>
</table>

#### Mobility in soil

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,4'-methylenedianiline</td>
<td>LOW (KOC = 4950)</td>
</tr>
</tbody>
</table>

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters. Wastes resulting from use of the product must be disposed of on-site or at approved waste sites.

Aromatic amines (arylamines), particularly primary aromatic amines, covalently and irreversibly bind to humic substances present in most natural waters. All metabolites with moieties of: anilines, benzidines and toluidines are of environmental concern. Anilines and benzidines are both acutely toxic and toxic depending on the specific aquatic species (except algae). Toluidines represent a similar concern. It has been speculated that aqueous solutions of aromatic amines can be oxidised by organic radicals, but there are no actual data on reaction rates. Based on a study of reaction rate data for these compounds an estimate of the half life of aromatic amines in water is approximately 100 days, assuming a perosy radical concentration of 10-10 mole/L in sunlit, oxygenated water for 4,4'-methylenedianiline (MDA):

The vapor pressure of MDA at 25°C has been estimated to be 2.82×10^-6 atm (2.15×10^-7 mm Hg). Organic compounds with a vapor pressure of 2.15×10^-7 mm Hg will exist in the air mostly as an aerosol and partly in the vapor phase. Atmospheric aerosol, will be removed from the atmosphere by rain/snow scavenging and dry deposition. MDA has an estimated Koc value of 174. It will be weakly to moderately adsorbed to suspended solids and sediment in water, and a large percentage of MDA may exist in water in the dissolved state where it is susceptible to degradation via chemical/biological processes. As the water solubility of amine salts is higher than the free base, the concentration of dissolved MDA will increase in natural waters as the pH decreases below 7. However, aromatic amines, particularly primary aromatic amines, covalently and irreversibly bind to humic substances present in most natural waters Therefore, in deference to moderate/low physical adsorption, MDA will become strongly bound (through covalent bonds) to humic materials in suspended solids and sediment present in most waters. Therefore, the percentage of MDA present in water may be much lower than is expected from simple physical adsorption of the compound. Organic compounds with Henry’s law constants <3.7×10^-7 atm-m3/mole are essentially non-volatile in water. Therefore, MDA, with an estimated H of 5.99×10^-11 atm-m3/mole, will remain essentially non-volatile in water. Based on a value of 1.59 for log Kow and a regression equation, the estimated bioconcentration factor for MDA in fathead minnow, bluegill sunfish, rainbow trout, and mosquito fish is 9.5. Therefore, MDA will not bioconcentrate in aquatic organisms. Carp (Cyprinus carpio) were grown in a model river consisting of natural river water, 0.5% volume per volume (v/v) river bottom sludge, and 0.1 mg/L methylene-di-p-phenylene isocyanate (MDI) in an outdoor stainless steel tank for 8 weeks with water flowing in the tank at rates of 4-14 cm/sec. Neither MDI nor its decomposition product, MDA, was detected (detection limit ~0.1 mg/kg) in the whole body of fish. It was concluded that MDI and MDA do not bioaccumulate in carp (III 1981). No data were located in the literature that would suggest that MDA will biomagnify in animals of higher trophic level via food chain biotransfer (e.g., bioaccumulation in algae < bioaccumulation in fish < bioaccumulation in human). This is not surprising, considering the low Kow value (indicative of low accumulation in lipids) and easy metabolism of the compound in higher trophic level animals. The estimated Koc value of 174 indicates that the mobility of MDA in soils having low organic carbon content will be moderate to high. However, besides the physical adsorption to organic matter in soils, the compound will also become bound to organic matter (humates) by stronger covalent bonds. In soils that exhibit this covalent bonding behavior, the mobility of MDA will be low and the rate of leaching from soil to groundwater will not be important.

No data were located in the literature that would suggest that MDA will biomagnify in animals of higher trophic level via food chain biotransfer (e.g., bioaccumulation in algae < bioaccumulation in fish < bioaccumulation in human). This is not surprising, considering the low Kow value (indicative of low accumulation in lipids) and easy metabolism of the compound in higher trophic level animals. The estimated Koc value of 174 indicates that the mobility of MDA in soils having low organic carbon content will be moderate to high. However, besides the physical adsorption to organic matter in soils, the compound will also become bound to organic matter (humates) by stronger covalent bonds. In soils that exhibit this covalent bonding behavior, the mobility of MDA will be low and the rate of leaching from soil to groundwater will not be important.
SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste chemicals:
- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Management Authority for disposal.
- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorised landfill.

Contaminated packing materials: Refer to section above

Precautions for Transport: Refer to section above

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant

Land transport (UN)

UN number 2651
UN proper shipping name 4,4'-DIAMINODIPHENYL- METHANE

Transport hazard class(es)
- Class 6.1
- Subrisk Not Applicable

Packing group III
Environmental hazard Environmentally hazardous

Special precautions for user
- Special provisions Not Applicable
- Limited quantity 5 kg

Air transport (ICAO-IATA / DGR)

UN number 2651
UN proper shipping name 4,4'-Diaminodiphenylmethane

Transport hazard class(es)
- ICAO/IATA Class 6.1
- ICAO / IATA Subrisk Not Applicable
- ERG Code 6L

Packing group III
Environmental hazard Environmentally hazardous

Special precautions for user
- Special provisions Not Applicable
- Cargo Only Packing Instructions 677
- Cargo Only Maximum Qty / Pack 200 kg
- Passenger and Cargo Packing Instructions 670
- Passenger and Cargo Maximum Qty / Pack 100 kg
- Passenger and Cargo Limited Quantity Packing Instructions Y645
- Passenger and Cargo Limited Maximum Qty / Pack 10 kg

Continued...
Sea transport (IMDG-Code / GGVSee)

| UN number | 2651 |
| UN proper shipping name | 4,4'-DIAMINODIPHENYLMETHANE |

| Transport hazard class(es) | IMDG Class 6.1 |
| | IMDG Subrisk Not Applicable |

| Packing group | III |
| Environmental hazard | Marine Pollutant |

| Special precautions for user | EMS Number F-A, S-A |
| Special provisions | Not Applicable |
| Limited Quantities | 5 kg |

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

Precautions for Transport

Transportation precautions:
- Documentation covering all dangerous goods carried on the vehicle
- The transport unit must be placarded and marked in accordance with relevant transporting requirements.
- Personal protective equipment must be in sufficient quantities and suitable for use by the driver of the vehicle and where required for escape purposes, any other persons travelling in the vehicle.
- Toxic substances can have subsidiary risks of Class 3, 4, 5 or 8, and dangerous goods of Classes 1, 3, 4, 5, and 8 can have a subsidiary risk of Class 6.1. The hazards associated with subsidiary risks must be taken into account.
- Likely to be incompatible however refer to SDS for further details:
  - Class 2.1, 3, 4.1, 4.2, 4.3
  - Incompatible for transport with foodstuffs (including stock feed).
  - If applicable, use appropriate types of segregation devices to isolate incompatible dangerous goods:
  - Routes for road vehicles should avoid heavily populated or environmentally sensitive areas, congested crossings or a concentration of people
  - Vehicle exhaust or hot engine components must be shielded to ensure cargo temperatures cannot be raised.

Suitable Containers
See section 7

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

| 4,4'-METHYLENEDIANILINE(101-77-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS |
| China Inventory of Existing Chemical Substances |
| China Inventory of Hazardous Chemicals (Chinese) |
| International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs |

| National Inventory | Status |
| Australia - AICS | Y |
| Canada - DSL | Y |
| Canada - NDSL | N (4,4'-methyleneedianiline) |
| China - IECSC | Y |
| Europe - EINEC / ELINCS / NLP | Y |
| Japan - ENCS | Y |
| Korea - KECI | Y |
| New Zealand - NZIoC | Y |
| Philippines - PICCS | Y |
| USA - TSCA | Y |

Legend: Y = All ingredients are on the inventory
N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing (see specific ingredients in brackets)

SECTION 16 OTHER INFORMATION

Other information
Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations
PC – TWA: Permissible Concentration-Time Weighted Average
PC – STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer

Continued...
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL: No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

Disclaimer
The information in the SDS applies only for the specified product and does not include mixtures of this product with other substances and mixtures. The SDS provides product safety information for personnel trained to use this product only.

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