

SAFETY DATA SHEET

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Regulation: According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

1. Identification

1.1 Product identifier

1.1.1 Product name: KONNATE TM-20

1.1.2 Other means of identification: Not available

1.2 Recommended use of the chemical and restrictions on use

1.2.1 Recommended use: Soft molded foam, seat cushion, architecture, artist, automotive parts, home appliances and industrial chemicals

1.2.2. Restrictions on use: Do not use for purposes other than those recommended.

1.3 Details of the supplier of the safety data sheet

1.3.1 Manufacturer

Company name: TDI Plant, Hanwha Solutions Co, Ltd.

Address: 46-47, Yeosusandan 2-ro, Yeosu-si, Jeollanam-do, Korea

Prepared by: TDI Production Team

Contact Telephone: +82-61-688-4888

1.3.2 Supplier & Distributor

Company name: Hanwha Solutions Co, Ltd.

Address: Hanwha Building, 86 Cheonggyecheon-ro, Jung-gu, Seoul, Korea

Prepared by: TDI Sales Team

Contact Telephone: +82-2-729-2700

1.4 Emergency phone number

Emergency phone : +1 201-308-6615 (Ext.801) (Any problems that occurs in U.S.A)

2. Hazard(s) identification

2.1 Classification of the substance or mixture

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Physical / Chemical Hazards: Not classified

Health Hazards:

Acute toxicity (inhalation: vapors): Category 1

Skin corrosion/irritation: Category 2

Eye Damage/irritation: Category 2A

Respiratory sensitization: Category 1

Skin sensitization: Category 1

Carcinogenicity: Category 2

Specific target organ toxicity (Single exposure): Category 3 (respiratory tract irritation)

Specific target organ toxicity (repeated exposure): Category 2

Environmental Hazards: Not classified

2.2 Label elements, including precautionary statements

o Pictogram and symbol:



o **Signal word:** Danger

o **Hazard statements:**

H315 Causes skin irritation.

H317 May cause an allergic skin reaction.

H319 Causes serious eye irritation

H330 Fatal if inhaled.

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

H335 May cause respiratory irritation.

H351 Suspected of causing cancer.

H373 May cause damage to organs through prolonged or repeated exposure.

o **Precautionary statements:**

- **Prevention:**

P201 Obtain special instructions before use.

P202 Do not handle until all safety precautions have been read and understood.

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

P261 Avoid breathing dust/fume/gas/mist/vapors/spray.

P264 Wash your hands thoroughly after handling.

P271 Use only outdoors or in a well-ventilated area.

P272 Contaminated work clothing should not be allowed out of the workplace.

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

P281 Use personal protective equipment as required.

P284 Wear respiratory protection.

P285 In case of inadequate ventilation wear respiratory protection.

- **Treatment:**

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.

P304+P341 If inhaled: If breathing is difficult, 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.

P308+P313 If exposed or concerned: Get medical advice/ attention.

P310 Immediately call a poison center or doctor/physician.

P312 Call a poison center or doctor/physician you feel unwell.

P314 Get medical advice/attention if you feel unwell.

P320 Specific treatment is urgent (see Section 8 on this label).

P321 Specific treatment (see Section 8 on this label).

P332+P313 If skin irritation occurs: Get medical advice/ attention.

P333+P313 If skin irritation or rash occurs: Get medical advice/attention.

P337+P313 If eye irritation persists: Get medical advice/attention.

P342+P311 If experiencing respiratory symptoms: Call a poison center or doctor/physician.

P362 Take off contaminated clothing and wash before reuse.

P363 Wash contaminated clothing before reuse.

- **Storage:**

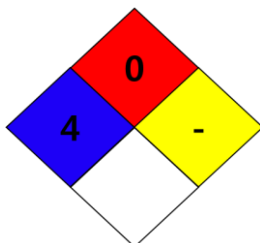
P403+P233 Store in a well-ventilated place. Keep container tightly closed.

P405 Store locked up.

- **Disposal:**

P510 Dispose the contents/container in accordance with local/regional/national/international regulations.

2.3 Other hazard information not included in hazard classification (National Fire Protection Association; NFPA)



o **Health:** 4

o **Flammability:** 0

o **Reactivity:** -

o **Specific hazard:** -

3. Composition/information on ingredients

Component	Common name and synonyms	CAS No.	Conc. / %
Toluene diisocyanate	Methyl-m-phenylene isocyanate	26471-62-5	75~80
Polymethylene polyphenylisocyanate	Polymethylene polyphenylisocyanate polymer	9016-87-9	12~15
4,4'-Diphenylmethane diisocyanate	1,1'-Methylenebis (4-isocyanatobenzene)	101-68-8	7~8.75
2,4'-Diphenylmethane diisocyanate	Diphenylmethane-2,4'-diisocyanate	5873-54-1	1~1.25

4. First aid measures

4.1 Description of first aid measures

Eye contact

- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If eye irritation persists: Get medical advice/attention.

Skin contact

- If skin irritation or rash occurs: Get medical advice/attention.
- Take off contaminated clothing and wash before reuse.
- For hot product, immediately immerse in or flush the affected area with large amounts of cold water to dissipate heat.
- Call emergency medical service.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.

Inhalation

- If inhaled: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
- Immediately call a poison center or doctor/physician.
- If exposed to excessive levels of dusts or fumes, remove to fresh air and get medical attention if cough or other symptoms develop.

Ingestion

- If exposed or concerned: Get medical advice/ attention.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or others proper respiratory medical device.

4.2 Most important symptoms and effects, both acute and delayed acute effects

- Inhalation: May cause acute toxic effects.
- Skin contact: Contact with this substance will cause skin irritation moderately.

- Eye contact: May cause irritation of eyes.

4.3 Indication of immediate medical attention and notes for physician

- Exposures require specialized first aid with contact and medical follow-up.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

5. Fire-fighting measures

5.1 Extinguishing media

- **Suitable extinguishing media:** dry chemical, Carbon dioxide, foam-extinguishing agent
- **Unsuitable extinguishing media:** Water

5.2 Specific hazards arising from the chemical

- Thermal decomposition products: Cyanide, carbon oxides, nitrogen oxide, TDI vapors, hydrogen chloride, hydrogen cyanide
- Vapor-air mixtures are explosive above flash point.
- Material may produce irritating and highly toxic gases from decomposition by heat and combustion during burning

5.3 Special protective equipment and precautions for fire-fighters

- Rescuers should put on appropriate protective gear.
- Evacuate area and fight fire from a safe distance.
- Substance may be transported in a molten form.
- Dike fire-control water for later disposal; do not scatter the material.
- Move containers from fire area if you can do it without risk.
- Fire involving Tanks; Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Fire involving Tanks; Cool containers with flooding quantities of water until well after fire is out.
- Fire involving Tanks; Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Fire involving Tanks; Always stay away from tanks engulfed in fire.
- Fire involving Tanks; For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Avoid breathing dust/fume/gas/mist/vapors/spray.
- Clean up spills immediately, observing precautions in Protective Equipment section.
- Isolate hazard area.
- Keep unnecessary and unprotected personnel from entering.
- Eliminate all ignition sources.
- Stop leak if you can do it without risk.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

6.2 Environmental precautions

- Prevent entry into waterways, sewers, basements or confined areas.

6.3 Methods and materials for containment and cleaning up

- Absorb spills with inert material (e.g., dry sand or earth), then place in a chemical waste container.
- Reduce dust and prevent scattering by moistening with water.
- Absorb the liquid and scrub the area with detergent and water.

- TDI neutralizer

Powder, aqueous ammonia, alcoholic solution and calcium hydroxide are suitable as neutralizing agent when the leak.

- | | |
|------------------------|-------------|
| 1) Powder | |
| Sawdust | 23.0 WT% |
| Clay | 38.5 WT% |
| Ethanol | 19.2 WT% |
| Triethanol amine | 3.8 WT% |
| Ammonia concentrations | 3.8 WT% |
| Water | 11.7 WT% |
| 2) Aqueous ammonia | |
| Ammonia concentrations | 3 - 8 WT% |
| Liquid detergent | 0.2-0.5 WT% |
| Water | 90-95 WT% |
| 3) Alcoholic solution | |
| Alcohol | 50 WT% |
| Ammonia concentrations | 5 WT% |
| Water | 45 WT% |
| 4) Calcium hydroxide | |

- *Caution) 1. Alcohol solution must be careful when you use it to fire flammable.
 2. Neutralizer amount is equal or more to the amount of spill.
 3. If the neutralizer is not urgently prepared, use the wet sand in a simple way.

7. Handling and storage

7.1 Precautions for safe handling

- Do not handle until all safety precautions have been read and understood.
- Wash your hands thoroughly after handling.
- Use only outdoors or in a well-ventilated area.
- Contaminated work clothing should not be allowed out of the workplace.
- Follow all MSDS/label precautions even after container is emptied because they may retain product residues.
- Loosen closure cautiously before opening.
- Avoid prolonged or repeated contact with skin.
- Avoid contact with water.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a cool, well-ventilated place. Keep container tightly closed.
- Empty drums should be completely drained, properly bunged, and promptly returned to a drum reconditioner, or properly disposed of.
- It is made to freeze from below 4 °C and DIMER creates is paid attention from high temperature
- Storage temperature : 20 ~ 30 °C

8. Exposure controls/personal protection

8.1 Occupational Exposure limits

<Toluene diisocyanate>

- o **ACGIH:** TWA=0.005 ppm, STEL=0.02ppm
- o **Biological exposure index:** 5 µg/g
- o **OSHA:** Not available
- o **NIOSH:** Not available
- o **EU regulation:**
 - Belgium: TWA=0.005ppm(0.037mg/m³), STEL=0.02ppm(0.14mg/m³)
 - France: TWA=0.01ppm(0.08mg/m³), STEL=0.02ppm(0.16mg/m³)

- Italy: TWA=0.005ppm, STEL=0.02ppm

o **Other:**

- Colombia: TWA=0.02ppm, STEL=0.005ppm
- Dominican Republic: TWA=0.005ppm, STEL=0.02ppm
- Bahrain: TWA=0.01ppm(0.08mg/m³)

<**Polymethylene polyphenylisocyanate**>

o **ACGIH:** Not available

o **Biological exposure index:** Not available

o **OSHA:** Not available

o **NIOSH:** Not available

o **EU regulation:**

- Germany: TWA= 0.05mg/m³ MAK (Respirable fraction)

o **Other:**

- Canada: TWA=0.07 mg/m³

<**4,4'-Diphenylmethane diisocyanate**>

o **ACGIH:** TWA=0.005 ppm((listed under Methylene bisphenyl isocyanate (MDI))

o **Biological exposure index:** Not available

o **OSHA:** Ceiling=0.2mg/m³

o **NIOSH:** TWA=0.005 ppm((listed under Methylene bisphenyl isocyanate (MDI))

o **EU regulation:**

- Belgium: TWA=0.005ppm(0.052mg/m³)
- Czech Republic: TWA=0.05 mg/m³
- France: TWA=0.1 mg/m³ [VME]

o **Other:**

- China: TWA=0.05 mg/m³, STEL=0.1 mg/m³
- Canada: TWA=0.005 ppm((listed under Methylene bisphenyl isocyanate (MDI))
- Japan: TWA=0.05 mg/m³ OEL

<**2,4'-Diphenylmethane diisocyanate**>

o **ACGIH:** Not available

o **Biological exposure index:** Not available

o **OSHA:** Not available

o **NIOSH:** Not available

o **EU regulation:**

- Germany: TWA= 0.05 mg/m³ AGW
- Poland: TWA=0.03 mg/m³ NDS
- Austria: TWA=0.05 mg/m³ (listed under Diphenylmethane-diisocyanate);)

o **Other:** Not available

8.2 Exposure controls

Appropriate engineering controls

- Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.
- If user operations generate dust, fume, or mist, use ventilation to keep exposure to airborne contaminants below the recommended exposure limit.
- Facilities for storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Individual protection measures, such as personal protective equipment

Respiratory protection

- Wear NIOSH or approved full or half face piece (with goggles) respiratory protective equipment when necessary.

Eye protection

- Wear the protective glasses or breathable safety goggles to protect from vaporous state organic material causing eye irritation or other disorder.
- An eye wash unit and safety shower station should be available nearby work place.

Hand protection

- Wear appropriate protective gloves by considering physical and chemical properties of chemicals.

Body protection

- Wear appropriate resistant protective clothing by considering physical and chemical properties of chemicals.

9. Physical and chemical properties
9.1 Information on basic physical and chemical properties
Appearance

Description:	Viscous liquid
Color:	Brown
Odor:	Not available
Odor threshold:	0.05ppm
pH:	Not available
Melting point/freezing point:	4°C
Initial boiling point and boiling range:	260°C
Flash point:	135°C(estimated)
Evaporation rate:	Not available
Flammability (solid, gas):	Not applicable
Upper/lower flammability or explosive limits:	Not applicable
Vapor pressure:	1X10 ⁻⁵ hPa(25 °C)
Vapor density:	Not available
Relative density	1.23 at 25 °C
Solubility:	Insoluble
Solubility in organic solvents:	Not available
Partition coefficient: n-octanol/water:	Not available
Auto ignition temperature:	> 600 °C
Decomposition temperature:	Not available
Viscosity:	Max. 30 cPs at 25 °C

“NOTE: The physical data presented above are typical values and should not be construed as a specification”

10. Stability and reactivity
10.1 Reactivity/Chemical stability/Possibility of hazardous reactions

- Stable(Non-hazardous polymerization occurs slowly above 40 °C)
- Reacts exothermically with water yielding carbon dioxide and an organic base.
- May dark brown on exposure to sunlight
- Toxic gas that may accumulate in a closed space

10.2 Conditions to avoid:

- Keep away from heat/sparks/open flames/hot surfaces.
- Containers may be exploded and ruptured when heated.

10.3 Incompatible materials:

- Water, Acid, acyl chloride, alcohol, aluminum, amines, ammonia, aniline, strong bases, copper and copper alloys, activated hydrogen, metal, strong oxidizing agents, plastics, rubber, coating, polyurethane, surface active agents, zinc alloy

10.4 Hazardous decomposition products:

- Thermal decomposition products: highly toxic hydrogen cyanide, toxic and hazardous oxides of carbon and nitrogen, TDI vapors

11. Toxicological information	
Information on toxicological effects	
(a) Acute toxicity	
Oral	Not classified(ATEmix>2,000 mg/kg)
	- Toluene diisocyanate: Rat (female), LD ₅₀ =4,130 mg/kg bw (OECD TG 401) - Polymethylene polyphenylisocyanate: Rat, LD ₅₀ > 10,000 mg/kg bw - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: Rat, LD ₅₀ > 2,000 mg/kg bw (84/449/EEC, GLP) (read-across CAS No. 26447-40-5)
Dermal	Not classified(ATEmix>2,000 mg/kg)
	- Toluene diisocyanate: Rabbit, LD ₅₀ >9,400 mg/kg bw (OECD TG 402) - Polymethylene polyphenylisocyanate: Rabbit, LD ₅₀ > 10,000 mg/kg bw - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: Rat, LD ₅₀ > 9,400 mg/kg bw(OECD TG 402)(read-across CAS No. 9016-87-9)
Inhalation	Category 1(ATEmix=0.3 mg/L)
	- Toluene diisocyanate: Rat, LC ₅₀ (4h) = 0.234 mg/L (OECD TG 403) - Polymethylene polyphenylisocyanate: Rat, LC ₅₀ (4h) = 0.490 mg/L - 4,4'-Diphenylmethane diisocyanate: Rat, LC ₅₀ (1h) > 2.24 mg/L (OECD TG 403, GLP) - 2,4'-Diphenylmethane diisocyanate: Rat, LC ₅₀ (4h) = 0.645 mg/L (OECD TG 403, GLP)
(b) Skin Corrosion/ Irritation	Category 2
	- Toluene diisocyanate: In skin irritation test with rabbit for 72h, moderately irritating was shown (PDII: 4.7) - Polymethylene polyphenylisocyanate: MDI is a known skin and eye irritant. - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: In skin irritation test with rabbit, irritating was shown (edema: 1.33)(not fully reversible within: 8 days)(OECD TG 404)
(c) Serious Eye Damage/ Irritation	Category 2A
	- Toluene diisocyanate: In an eye irritation study with rabbits, All three groups showed severe irritation of the conjunctivae, which continue for 18 days in the unwashed and two-second-wash groups, and for 20 days post-application in the group receiving the four-second-wash. (cornea score=0.66/4, iris score=0.33/2, conjunctivae score=3/3, chemosis score=4/4) - Polymethylene polyphenylisocyanate, 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: MDI is a known skin and eye irritant.
(d) Respiratory sensitization	Category 1
	- Toluene diisocyanate: In respiratory sensitization study with guinea pigs(female), results show that detection of antibodies and elicitation of pulmonary hypersensitivity response is dependent upon physicochemical properties of <i>hapten-protein</i> conjugate. - Polymethylene polyphenylisocyanate, 2,4'-Diphenylmethane diisocyanate: MDI is a well-established respiratory sensitiser in animals and humans. - 4,4'-Diphenylmethane diisocyanate: In respiratory sensitization study with guinea pigs, respiratory sensitization was shown
(e) Skin Sensitization	Category 1
	- Toluene diisocyanate: In skin sensitization: Local Lymph Node Assay with mice, the substance induces skin sensitization. (OECD TG 429) - Polymethylene polyphenylisocyanate, 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: MDI has also a skin sensitising potential. Animal studies indicate that MDI is a strong allergen.

(f) Carcinogenicity	<p>Category 2</p> <p><Toluene diisocyanate> - EU CLP 1272/2008: Carc. 2 (Suspected of causing cancer) - ACGIH: A4 (Not Classifiable as a Human Carcinogen) - IARC Group: 2B (Possibly Carcinogenic to Humans) - NTP: R (Reasonably Anticipated To Be A Human Carcinogen)</p> <p><Polymethylene polyphenylisocyanate> - IARC : Group 3 (Not classifiable as to its carcinogenicity to humans)</p> <p><4,4'-Diphenylmethane diisocyanate> - EU CLP 1272/2008 : Carc. 2 (Suspected of causing cancer) - IARC : Group 3 (Not classifiable as to its carcinogenicity to humans)</p>
(g) Mutagenicity	<p>Not classified</p> <p><Toluene diisocyanate> <i>In vitro: Bacterial Reverse Mutation Assay: with/ without metabolic activation: Positive (OECD TG 471)</i> <i>In vivo: Mammalian Erythrocyte Micronucleus Test: with/ without metabolic activation: Negative (OECD TG 474, GLP)</i></p> <p><Polymethylene polyphenylisocyanate> From the body of available data it is concluded that MDI does not have genotoxic properties. Conflicting results were obtained in in vitro test systems. The results, from a recently performed in vivo micronucleus test, indicate that aerosolized, inhaled MDI at concentrations as high as 118 mg/m³ air (a concentration high enough to produce portal-of-entry-specific toxic effects, including statistically significantly increased lung weights) did not induce cytogenetic damage in vivo.</p> <p><4,4'-Diphenylmethane diisocyanate> <i>In vitro: Bacterial Reverse Mutation Assay: with/ without metabolic activation: Negative (EU Method B.13/14)</i> <i>In vivo: Mammalian Erythrocyte Micronucleus Test: with/ without metabolic activation: Negative (OECD TG 474, GLP)</i></p>
(h) Reproductive toxicity	<p>Not classified</p> <p>- Toluene diisocyanate: Clinical signs of toxicity (nasal discharge in males and red-tinged fur in females) were observed in the high-exposure F0 group. And histopathology revealed a significant increase in the incidence of rhinitis in the nasal turbinate of F0 animals (both sexes). Hyperplasia and dysplasia of the respiratory epithelium of F0 males and hyperplasia was significantly increased in F0 females. In the high-exposure group (males), there was a significant increase in the incidence of submucosal lymphoid infiltrates in both the larynx and the trachea as well as a significant increase in the incidence of intracellular eosinophilic droplets. (NOAEC(P)=0.08 ppm, NOAEC(F1) =0.3 ppm, NOAEC(F2) =0.02 ppm) (OECD TG 416, GLP)</p> <p>- Polymethylene polyphenylisocyanate: According to reproductive toxicity study with rat, there were no significant adverse effects. (NOAEL developmental=3 mg/m³ air)</p> <p>- 4,4'-Diphenylmethane diisocyanate: According to Prenatal Developmental Toxicity Study with rat, there were no significant adverse effects. (NOAEL developmental=3mg/m³ air, LOAEL embryo/fetotoxicity=9 mg/m³ air) (OECD TG 414)</p> <p>- 2,4'-Diphenylmethane diisocyanate: According to Prenatal Developmental Toxicity Study with rat, at this concentration clear signs of developmental (embryo-/foeto-) toxicity in the form of reduced placental and foetal body weights and an increased occurrence of foetal skeletal (and overall) variations and retardation were recorded (NOAELdevelopmental toxicity=4 mg/m³ air)(OECD TG 414)</p>
(i) Specific target organ toxicity (single exposure)	<p>Category 3 (respiratory tract irritation)</p> <p>- Toluene diisocyanate: In an experiment, male Sprague-Dawley rats (n=4) were exposed head-only for 3 h to a 2,4- and 2,6-TDI mixture (80:20). Transient decreases</p>

	<p>in weight gain occurred post-exposure at the two highest concentrations, and rales were heard in one animal exposed at 1.45 ppm. (RD50(decrease of respiratory rate)=2.12 ppm) (Shiotsuka 1987b)</p> <p>- Polymethylene polyphenylisocyanate: In acute oral toxicity study with rats, one rat in this group displayed salivation, nasal discharge and an abnormal yellow urine excretion during the first 24 hours of observation.</p> <p>- 4,4'-Diphenylmethane diisocyanate: In acute inhalation toxicity study with rats, there were observed an increase in respiratory rate and lung weight</p> <p>- 2,4'-Diphenylmethane diisocyanate: In acute oral toxicity study with rats, one rat in this group displayed salivation, nasal discharge and an abnormal yellow urine excretion during the first 24 hours of observation. (read-across CAS No. 9016-87-9)(OECD TG 401)</p>
(j) Specific target organ toxicity (repeat exposure)	<p>Category 2</p> <p>- Toluene diisocyanate: In a combined chronic toxicity and carcinogenicity study with mice, increased clinical signs of swollen abdomens and opaque watery eyes were observed from week 65 onwards. And histopathology revealed marked inflammatory processes in trachea, larynx, bronchi, lungs and predominantly in nasal turbinate (chronic and necrotic rhinitis) of male and female animals. (NOAEC(male)=0.05 ppm, NOAEC(female)<0.05 ppm, LOAEC(male)=0.15 ppm, LOAEC(female)=0.05 ppm) (OECD TG 453, GLP) This substance has already been classified for specific health hazard categories (acute inhalation, skin/respiratory sensitization, skin/eye/respiratory irritation, etc.) due to membrane irritation, sensitization, etc., and therefore should not be classified for specific target organ toxicity.</p> <p>- Polymethylene polyphenylisocyanate: In a chronic toxicity study with rats, the compound-related changes were found in the nasal cavity, the lungs and the mediastinal lymph nodes, and to some degree they were already present after 1 year of exposure. Histopathology of the organs/tissues investigated showed that exposure to 6.0 mg/m³ over 2 years was related to the occurrence of pulmonary tumors in males (6 adenomas and 1 adenocarcinoma) and females (2 adenomas). (NOAEC = 0.2 mg/m³, LOAEC = 1mg/m³) (OECD TG 453, GLP)</p> <p>- 4,4'-Diphenylmethane diisocyanate: In a chronic toxicity study with rats, a dose-dependent impairment of the lung function in the sense of an obstructive-restrictive malfunction with diffusion disorder, increased lung weights, an inflammatory reaction with increased appearance of lymphocytes (but not of granulocytes) in the lung in the high dose group as a sign of specific stimulation of the immune system by MDI, an intermediately retarded lung clearance in the high dose group as well as dose-dependent interstitial and peribronchiolar fibrosis, alveolar bronchiolisations and a proliferation of the alveolar epithelium, which was classified as preneoplastic, as well as a bronchiolo-alveolar adenoma were ascertained. (Directive 87/302/EEC, Part B, p37.)</p> <p>- 2,4'-Diphenylmethane diisocyanate: Long-term exposure to MDI tends to cause restriction of pulmonary function and decline in pulmonary diffusing capacity. In addition to reports of cases of asthma, hypersensitivity pneumonitis, pleuritis, and progressive fibrosing alveolitis it may be concluded that chronic exposure to even low levels (mostly undetermined or below 0.05 mg/m³) of MDI carries a risk of respiratory disease. (NOAEL = 0.2 mg/m³)</p>
(k) Aspiration Hazard	Not available

12. Ecological information

12.1 Toxicity	
Acute toxicity	<p>Not classified(ATEmix=13.62mg/L)</p> <p><Toluene diisocyanate></p> <p>Fish: <i>Oncorhynchus mykiss</i>, LC₅₀(96h) =133 mg/L static (OECD TG 203)</p> <p>Invertebrate: <i>Daphnia magna</i>, EC₅₀(48h) =12.5 mg/L (OECD TG 202)</p>

	<p>Algae: <i>Skeletonema costatum</i>, EC₅₀(96h) = 3,230 mg/L static (OECD TG 201) <Polymethylene polyphenylisocyanate> Fish: <i>Brachydanio rerio</i>, LC₅₀(96h) > 1,000 mg/L static (OECD TG 203) Invertebrate: <i>Daphnia magna</i>, EC₅₀(24h) = 129.7 mg/L (OECD TG 202) Algae: Not available <4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate > Fish: <i>Brachydanio rerio</i>, LC₅₀(96h) > 1,000 mg/L static (OECD TG 203) (read-across CAS No. 9016-87-9) Invertebrate: <i>Daphnia magna</i>, EC₅₀(24h) = 129.7 mg/L (OECD TG 202) (read-across CAS No. 9016-87-9) Algae: Not available</p>
Chronic toxicity	Not classified
	<p><Toluene diisocyanate> Invertebrate: <i>Daphnia magna</i>, NOEC(21d) = 1.1 mg/L (OECD TG 211, GLP) <Polymethylene polyphenylisocyanate> Invertebrate: <i>Daphnia magna</i>, NOEC(21d) ≥ 10 mg/L (OECD TG 211) <4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate > Invertebrate: <i>Daphnia magna</i>, NOEC(21d) ≥ 10 mg/L (OECD TG 211) (read-across CAS No. 9016-87-9)</p>
12.2 Persistence and degradability	<p>Persistence: - Toluene diisocyanate: Low persistency (log Kow is more than 4 estimated.) ((LogKow=3.43 (22°C, pH ca.7))) - Polymethylene polyphenylisocyanate: High persistency (log Kow is more than 4 estimated.) (LogKow=10.46) - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: High persistency (log Kow is more than 4 estimated.) (LogKow=4.51) (OECD TG 117) Degradability: - Toluene diisocyanate: Half lifecycle: 0.5 min (calculated) - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: Half lifecycle: 20h (25 °C) (calculated) (read-across CAS No. 101-77-9)</p>
12.3 Bio-accumulative potential	<p>Bioaccumulation: - Toluene diisocyanate: Bioaccumulation is expected to be low according to the BCF <500 (BCF = 136.4(estimated)) - Polymethylene polyphenylisocyanate: Bioaccumulation is expected to be low according to the BCF <500 (BCF = 268.1(estimated)) - 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: Bioaccumulation is expected to be low according to the BCF <500 (BCF = 200(OECD TG 305 E, GLP)) Biodegradation: - Toluene diisocyanate, Polymethylene polyphenylisocyanate, 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate : As not well-biodegraded, it is expected to have high accumulation potential in living organisms (0% biodegradation was observed after 28 days) (OECD TG 302 C)</p>
12.4 Mobility in soil	<p>- Toluene diisocyanate: High potency of mobility to soil. (Koc = 1,760(estimated)) - Polymethylene polyphenylisocyanate, 4,4'-Diphenylmethane diisocyanate, 2,4'-Diphenylmethane diisocyanate: High potency of mobility to soil. (Koc = 3.389X10⁴(estimated))</p>
12.5 Hazardous to the ozone layer	Not classified
12.6 Other adverse effects	Not available

13. Disposal considerations

13.1 Disposal method

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

13.2 Disposal precaution

Consider the required attentions in accordance with waste treatment management regulation.

14. Transport information

14.1 UN No.: 2206

14.2 UN Proper shipping name: DIISOCYANATE ISOCYANATES, TOXIC, N.O.S.
(contains toluene diisocyanate)

14.3 Transport Hazard class

ADR: 6.1
IMDG: 6.1
ICAO/IATA: 6.1
RID: 6.1

14.4 Packing group: II

14.5 Environmental hazards: Not applicable

14.6 Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code): Not Regulated

14.7 Special precautions for user

in case of fire: F-A
in case of leakage: S-A

15. Regulatory information

15.1 Safety, health and environmental regulation/legislation specific for the substance or mixture USA Regulatory Information

< Toluene diisocyanate >

TSCA (Toxic Substances Control Act): Section 8(b) inventory (Present)

Proposition 65: Regulated

OSHA Regulation: Not regulated

CERCLA Regulation: 100lb, 45.4kg

SARA 311/312 Hazard classes: Not regulated

SARA 302 Regulation: Not regulated

SARA 304 Regulation: Not regulated

SARA 313 Regulation: Regulated

Foreign Regulatory Information

Substance of Rotterdam Protocol: Not regulated

Substance of Stockholm Protocol: Not regulated

Substance of Montreal Protocol: Not regulated

Foreign Inventory Status

- Korea management information: Existing Chemical Substance (KE-10914), Accident precaution chemicals Phase-in substance subject to registration (437), Toxic Chemical (2010-1-611),
- European Inventory of Existing Commercial Chemical Substances(EINECS): Present (247-722-4)
- China management information: Inventory of Existing Chemical Substances (IECSC): Present (11919)
- Japan management information: Existing and New Chemical Substances (ENCS): (3)-2214
- Canada management information: Domestic Substances List (DSL): Present
- Australia management information: Australia Inventory of Chemical Substances (AICS): Present
- New Zealand management information: New Zealand Inventory of Chemicals (NZIoC): HSNO Approval: HSR003307
- Philippines management information: Philippines Inventory of Chemicals and Chemical Substances (PICCS): Present

< Polymethylene polyphenylisocyanate >

TSCA (Toxic Substances Control Act): Section 8(b) inventory (Present)

Proposition 65: Regulated

OSHA Regulation: Not regulated

CERCLA Regulation: Not regulated

SARA 311/312 Hazard classes: Not regulated

SARA 302 Regulation: Not regulated

SARA 304 Regulation: Not regulated

SARA 313 Regulation: Regulated

Foreign Regulatory Information

Substance of Rotterdam Protocol: Not regulated

Substance of Stockholm Protocol: Not regulated

Substance of Montreal Protocol: Not regulated

Foreign Inventory Status

- Korea management information: Existing Chemical Substance (KE-21487)
- China management information: Inventory of Existing Chemical Substances (IECSC): Present (40619)
- Japan management information: Existing and New Chemical Substances (ENCS): (7)-872
- Canada management information: Domestic Substances List (DSL): Present
- Australia management information: Australia Inventory of Chemical Substances (AICS): Present
- New Zealand management information: New Zealand Inventory of Chemicals (NZIoC): HSNO Approval: HSR003222
- Philippines management information: Philippines Inventory of Chemicals and Chemical Substances (PICCS): Present

16. OTHER INFORMATION

16.1 Indication of changes:

Preparation date: May 25, 2005

Version: 14

Revision date: June 09, 2020

16.2 Key literature reference and sources for data:

- National chemicals information systems; <http://ncis.nier.go.kr>
- Pubchem; <http://pubchem.ncbi.nlm.nih.gov/>
- AKRON; <http://ull.chemistry.uakron.edu/erd/>
- IARC Monographs on the Evaluation of Carcinogenic Risks to Humans; <http://monographs.iarc.fr>
- ECHA; <http://echa.europa.eu/web/guest>
- NIOSH(The National Institute for Occupational Safety and Health)
- ACGIH(American Conference of Governmental Industrial Hygienists)
- TOMES-LOLI®; <http://www.rightanswerknowledge.com/loginRA.asp>
- National Emergency Management Agency-Korea dangerous material inventory management system; <http://hazmat.mpss.kfi.or.kr/index.do>
- Waste Control Act enforcement regulation attached [1]
- EPISUITE Program ver.4.1

16.3 Abbreviations

ACGIH: American Conference of Governmental Industrial hygienists

NIOSH: The National Institute for Occupational Safety and Health

OSHA: Occupational Safety & Health Administration

IARC: International Agency for Research on Cancer

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road

IMDG: International Maritime Dangerous Goods

ICAO/IATA: International Civil Aviation Organization/ International Air Transport Association

RID: Regulations Concerning the International Transport of Dangerous Goods by Rail

16.4 Other

- Product should be handled, stored, and used in accordance with the generally accepted industrial hygiene

practices and in conformity with all the applicable legal regulations.

- The information provided herein is based on the knowledge possessed at this present time from the view point of safety requirements.
- It should, therefore, not be construed as guaranteeing specific properties.