# SAFETY DATA SHEET

# Opteon™ XL41 (R-454B) Refrigerant

| Version | Revision Date: | SDS Number: | Date of last issue: 2021/08/26 |
|---|---|---|---|
| 1.13 | 2022/01/06 | 2634680-00014 | Date of first issue: 2018/04/03 |

## 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Opteon™ XL41 (R-454B) Refrigerant

SDS-Identcode : 130000143545

**Manufacturer or supplier's details**

Company : The Chemours (Thailand) Company Limited

Address : Unit 1502, 15th Floor, GPF Witthayu Tower A, 93/1 Wireless Road, Lumpini, Pathumwan, Bangkok 10330, Thailand

Telephone : 0 2026 1818 (INT +66 2026 1818)

Emergency telephone number : 001-800-13-203-9987

**Recommended use of the chemical and restrictions on use**

Recommended use : Refrigerant

Restrictions on use : For professional and industrial installation and use only.
Do not use product for anything outside of the above specified uses

## 2. HAZARDS IDENTIFICATION

**GHS Classification**

Flammable gases : Category 1

Gases under pressure : Liquefied gas

**GHS label elements**

Hazard pictograms :

Signal word : Danger

Hazard statements : H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.

Precautionary statements :

**Prevention:**

P210 Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.

**Response:**

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 Eliminate all ignition sources if safe to do so.

**Storage:**

P410 + P403 Protect from sunlight. Store in a well-ventilated place.

**Other hazards which do not result in classification**

Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
Misuse or intentional inhalation abuse may cause death without warning symptoms, due to cardiac effects.
Rapid evaporation of the product may cause frostbite.
May displace oxygen and cause rapid suffocation.

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

**Components**

| Chemical name | CAS-No. | Concentration (% w/w) |
|---|---|---|
| Difluoromethane# | 75-10-5 | 68.9 |
| 2,3,3,3-Tetrafluoropropene# | 754-12-1 | 31.1 |

# Voluntarily-disclosed non-hazardous substance

## 4. FIRST AID MEASURES

General advice : In the case of accident or if you feel unwell, seek medical advice immediately.
When symptoms persist or in all cases of doubt seek medical advice.

If inhaled : If inhaled, remove to fresh air.
If not breathing, give artificial respiration.
If breathing is difficult, give oxygen.
Get medical attention immediately.

In case of skin contact : Thaw frosted parts with lukewarm water. Do not rub affected area.
Get medical attention immediately.

In case of eye contact : Get medical attention immediately.

If swallowed : Ingestion is not considered a potential route of exposure.

Most important symptoms and effects, both acute and delayed : May cause cardiac arrhythmia.
Other symptoms potentially related to misuse or inhalation abuse are
Cardiac sensitisation
Anaesthetic effects
Light-headedness
Dizziness
confusion
Lack of coordination
Drowsiness

Unconsciousness
Gas reduces oxygen available for breathing.
Contact with liquid or refrigerated gas can cause cold burns and frostbite.

Protection of first-aiders : No special precautions are necessary for first aid responders.

Notes to physician : Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life support should be used with special caution.

## 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Water spray
Alcohol-resistant foam
Carbon dioxide (CO2)
Dry chemical

Unsuitable extinguishing media : None known.

Specific hazards during firefighting : Vapours may form flammable mixture with air
Exposure to combustion products may be a hazard to health.
If the temperature rises there is danger of the vessels bursting due to the high vapor pressure.

Hazardous combustion products : Hydrogen fluoride
carbonyl fluoride
Carbon oxides
Fluorine compounds

Specific extinguishing methods : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Fight fire remotely due to the risk of explosion.
Use water spray to cool unopened containers.
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
Remove undamaged containers from fire area if it is safe to do so.
Evacuate area.

Special protective equipment for firefighters : Wear self-contained breathing apparatus for firefighting if necessary.
Use personal protective equipment.

## 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Evacuate personnel to safe areas.
Only trained personnel should re-enter the area.
Remove all sources of ignition.
Avoid skin contact with leaking liquid (danger of frostbite).
Ventilate the area.
Follow safe handling advice (see section 7) and personal pro-

tective equipment recommendations (see section 8).

| | | |
|---|---|---|
| Environmental precautions | : | Avoid release to the environment.<br>Prevent further leakage or spillage if safe to do so.<br>Retain and dispose of contaminated wash water. |
| Methods and materials for containment and cleaning up | : | Ventilate the area.<br>Non-sparking tools should be used.<br>Suppress (knock down) gases/vapours/mists with a water spray jet.<br>Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable.<br>Sections 13 and 15 of this SDS provide information regarding certain local or national requirements. |

## 7. HANDLING AND STORAGE

| | | |
|---|---|---|
| Technical measures | : | Use equipment rated for cylinder pressure. Use a backflow preventative device in piping. Close valve after each use and when empty. |
| Local/Total ventilation | : | If sufficient ventilation is unavailable, use with local exhaust ventilation.<br>If advised by assessment of the local exposure potential, use only in an area equipped with explosion-proof exhaust ventilation. |
| Advice on safe handling | : | Avoid breathing gas.<br>Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment<br>Keep container tightly closed.<br>Wear cold insulating gloves/ face shield/ eye protection.<br>Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point.<br>Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.<br>Prevent backflow into the gas tank.<br>Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems.<br>Close valve after each use and when empty. Do NOT change or force fit connections.<br>Prevent the intrusion of water into the gas tank.<br>Never attempt to lift cylinder by its cap.<br>Do not drag, slide or roll cylinders.<br>Use a suitable hand truck for cylinder movement.<br>Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.<br>Take precautionary measures against static discharges.<br>Take care to prevent spills, waste and minimize release to the environment. |

| | | |
|---|---|---|
| Conditions for safe storage | : | Cylinders should be stored upright and firmly secured to prevent falling or being knocked over.<br>Separate full containers from empty containers.<br>Do not store near combustible materials.<br>Avoid area where salt or other corrosive materials are present.<br>Keep in properly labelled containers.<br>Keep tightly closed.<br>Keep in a cool, well-ventilated place.<br>Keep away from direct sunlight.<br>Store in accordance with the particular national regulations.<br>Keep away from heat and sources of ignition. |
| Materials to avoid | : | Do not store with the following product types:<br>Self-reactive substances and mixtures<br>Organic peroxides<br>Oxidizing agents<br>Flammable liquids<br>Pyrophoric liquids<br>Pyrophoric solids<br>Self-heating substances and mixtures<br>Explosives |
| Recommended storage temperature | : | < 52 °C |
| Storage period | : | > 10 yr |
| Further information on storage stability | : | The product has an indefinite shelf life when stored properly. |

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Components with workplace control parameters**

Contains no substances with occupational exposure limit values.

| | | |
|---|---|---|
| **Engineering measures** | : | Minimize workplace exposure concentrations.<br>If sufficient ventilation is unavailable, use with local exhaust ventilation.<br>If advised by assessment of the local exposure potential, use only in an area equipped with explosion-proof exhaust ventilation. |

**Personal protective equipment**

| | | |
|---|---|---|
| Respiratory protection | : | If adequate local exhaust ventilation is not available or exposure assessment demonstrates exposures outside the recommended guidelines, use respiratory protection. |
| Filter type | : | Organic gas and low boiling vapour type |
| Hand protection | | |
| Material | : | Impervious gloves |

| | | |
|---|---|---|
| Remarks | : | Choose gloves to protect hands against chemicals depending on the concentration and quantity of the hazardous substance and specific to place of work. For special applications, we recommend clarifying the resistance to chemicals of the aforementioned protective gloves with the glove manufacturer. Wash hands before breaks and at the end of workday. Breakthrough time is not determined for the product. Change gloves often! |
| Eye protection | : | Wear the following personal protective equipment:<br>Chemical resistant goggles must be worn.<br>Face-shield |
| Skin and body protection | : | Wear the following personal protective equipment:<br>If assessment demonstrates that there is a risk of explosive atmospheres or flash fires, use flame retardant antistatic protective clothing. |
| Protective measures | : | Wear cold insulating gloves/ face shield/ eye protection. |
| Hygiene measures | : | If exposure to chemical is likely during typical use, provide eye flushing systems and safety showers close to the working place.<br>When using do not eat, drink or smoke.<br>Wash contaminated clothing before re-use. |

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | | |
|---|---|---|
| Appearance | : | Liquefied gas |
| Colour | : | colourless |
| Odour | : | slight, ether-like |
| Odour Threshold | : | No data available |
| pH | : | No data available |
| Melting point/freezing point | : | No data available |
| Initial boiling point and boiling range | : | -50.9 °C |
| Flash point | : | Not applicable |
| Evaporation rate | : | > 1<br>(CCL4=1.0) |

| | | |
|---|---|---|
| Flammability (solid, gas) | : | Flammable |
| Self-ignition | : | > 800 °C<br>Hot Surface Ignition Temperature per ASTM D8211-18 |
| Upper explosion limit / Upper flammability limit | : | Upper flammability limit<br>22 %(V)<br>Method: ASTM E681 |
| Lower explosion limit / Lower flammability limit | : | Lower flammability limit<br>11.25 %(V)<br>Method: ASTM E681 |
| Vapour pressure | : | 15,856 hPa (25 °C) |
| Relative vapour density | : | 2.2<br>(Air = 1.0) |
| Relative density | : | 0.98 (25 °C) |
| Density | : | 0.98 g/cm³ (25 °C)<br>(as liquid) |
| Solubility(ies) | | |
| Water solubility | : | No data available |
| Partition coefficient: n-octanol/water | : | Not applicable |
| Auto-ignition temperature | : | 496 °C |
| Decomposition temperature | : | No data available |
| Viscosity | | |
| Viscosity, kinematic | : | Not applicable |
| Explosive properties | : | Not explosive |
| Oxidizing properties | : | The substance or mixture is not classified as oxidizing. |
| Particle size | : | Not applicable |

## 10. STABILITY AND REACTIVITY

| | | |
|---|---|---|
| Reactivity | : | Not classified as a reactivity hazard. |
| Chemical stability | : | Stable if used as directed. Follow precautionary advice and avoid incompatible materials and conditions. |
| Possibility of hazardous reactions | : | Vapours may form flammable mixture with air<br>Can react with strong oxidizing agents.<br>Flammable gas. |

| | | |
|---|---|---|
| Conditions to avoid | : | Heat, flames and sparks. |
| Incompatible materials | : | Avoid impurities (e.g. rust, dust, ash), risk of decomposition.<br>Incompatible with acids and bases.<br>Incompatible with oxidizing agents.<br>Oxygen<br>Peroxides<br>peroxide compounds<br>Powdered metals |
| Hazardous decomposition products | : | No hazardous decomposition products are known. |

## 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure : Inhalation
Skin contact
Eye contact

**Acute toxicity**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Acute oral toxicity : Assessment: The substance or mixture has no acute oral toxicity

Acute inhalation toxicity : LC50 (Rat): > 520000 ppm
Exposure time: 4 h
Test atmosphere: gas
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 350000 ppm
Test atmosphere: gas
Remarks: Cardiac sensitisation

Lowest observed adverse effect concentration (Dog): > 350000 ppm
Test atmosphere: gas
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): > 735,000 mg/m3
Test atmosphere: gas
Remarks: Cardiac sensitisation

Acute dermal toxicity : Assessment: The substance or mixture has no acute dermal toxicity

**2,3,3,3-Tetrafluoropropene:**

Acute inhalation toxicity : LC50 (Rat): > 405800 ppm
Exposure time: 4 h
Test atmosphere: gas
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 120000 ppm
Test atmosphere: gas
Remarks: Cardiac sensitisation

Lowest observed adverse effect concentration (Dog): > 120000 ppm
Test atmosphere: gas
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): > 559,509 mg/m3
Test atmosphere: gas
Remarks: Cardiac sensitisation

**Skin corrosion/irritation**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Result : No skin irritation

**2,3,3,3-Tetrafluoropropene:**

Result : No skin irritation

**Serious eye damage/eye irritation**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Result : No eye irritation

**2,3,3,3-Tetrafluoropropene:**

Result : No eye irritation

**Respiratory or skin sensitisation**

**Skin sensitisation**

Not classified based on available information.

**Respiratory sensitisation**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Exposure routes : Skin contact
Result : negative

**2,3,3,3-Tetrafluoropropene:**

Exposure routes : Skin contact

Result : negative

**Germ cell mutagenicity**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)
Method: OECD Test Guideline 471
Result: negative

Test Type: Chromosome aberration test in vitro
Method: OECD Test Guideline 473
Result: negative

Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
Species: Mouse
Application Route: inhalation (gas)
Method: OECD Test Guideline 474
Result: negative

Germ cell mutagenicity - Assessment : Weight of evidence does not support classification as a germ cell mutagen.

**2,3,3,3-Tetrafluoropropene:**

Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)
Method: OECD Test Guideline 471
Result: positive

Test Type: Chromosome aberration test in vitro
Method: OECD Test Guideline 473
Result: negative

Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
Species: Mouse
Application Route: inhalation (gas)
Method: OECD Test Guideline 474
Result: negative

Test Type: In vivo mammalian alkaline comet assay
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 489
Result: negative

Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 474
Result: negative

| | | |
|---|---|---|
| Germ cell mutagenicity - Assessment | : | Weight of evidence does not support classification as a germ cell mutagen. |

**Carcinogenicity**

Not classified based on available information.

**Components:**

**2,3,3,3-Tetrafluoropropene:**

| | | |
|---|---|---|
| Result | : | negative |
| Carcinogenicity - Assessment | : | Weight of evidence does not support classification as a carcinogen |

**Reproductive toxicity**

Not classified based on available information.

**Components:**

**Difluoromethane:**

| | | |
|---|---|---|
| Effects on fertility | : | Species: Mouse<br>Application Route: Inhalation<br>Result: negative<br>Remarks: Based on data from similar materials |
| Effects on foetal development | : | Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test<br>Species: Rat<br>Application Route: inhalation (gas)<br>Method: OECD Test Guideline 414<br>Result: negative<br><br>Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test<br>Species: Rabbit<br>Application Route: inhalation (gas)<br>Method: OECD Test Guideline 414<br>Result: negative |
| Reproductive toxicity - Assessment | : | Weight of evidence does not support classification for reproductive toxicity |

**2,3,3,3-Tetrafluoropropene:**

| | | |
|---|---|---|
| Effects on fertility | : | Test Type: Two-generation reproduction toxicity study<br>Species: Rat<br>Application Route: inhalation (gas)<br>Method: OECD Test Guideline 416<br>Result: negative |
| Effects on foetal development | : | Test Type: Prenatal development toxicity study (teratogenicity)<br>Species: Rat<br>Application Route: inhalation (gas)<br>Method: OECD Test Guideline 414 |

Result: negative

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity, No effects on or via lactation

**STOT - single exposure**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Exposure routes : inhalation (gas)
Assessment : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less

**2,3,3,3-Tetrafluoropropene:**

Exposure routes : inhalation (gas)
Assessment : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less

**STOT - repeated exposure**

Not classified based on available information.

**Components:**

**Difluoromethane:**

Exposure routes : inhalation (gas)
Assessment : No significant health effects observed in animals at concentrations of 250 ppmV/6h/d or less.

**2,3,3,3-Tetrafluoropropene:**

Exposure routes : inhalation (gas)
Assessment : No significant health effects observed in animals at concentrations of 250 ppmV/6h/d or less.

**Repeated dose toxicity**

**Components:**

**Difluoromethane:**

Species : Rat, male and female
NOAEL : 49100 ppm
LOAEL : > 49100 ppm
Application Route : inhalation (gas)
Exposure time : 13 Weeks
Method : OECD Test Guideline 413

**2,3,3,3-Tetrafluoropropene:**

Species : Rat, male and female
NOAEL : 50000 ppm
LOAEL : >50000 ppm
Application Route : inhalation (gas)

Exposure time : 13 Weeks
Method : OECD Test Guideline 413

**Aspiration toxicity**

Not classified based on available information.

**Components:**

**Difluoromethane:**

No aspiration toxicity classification

**2,3,3,3-Tetrafluoropropene:**

No aspiration toxicity classification

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

**Components:**

**Difluoromethane:**

Toxicity to fish : LC50 (Fish): 1,507 mg/l
Exposure time: 96 h
Method: ECOSAR (Ecological Structure Activity Relationships)

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia (water flea)): 652 mg/l
Exposure time: 48 h
Method: ECOSAR (Ecological Structure Activity Relationships)

Toxicity to algae/aquatic plants : EC50 (green algae): 142 mg/l
Exposure time: 96 h
Method: ECOSAR (Ecological Structure Activity Relationships)

**2,3,3,3-Tetrafluoropropene:**

Toxicity to fish : LC50 (Cyprinus carpio (Carp)): > 197 mg/l
Exposure time: 96 h
Method: OECD Test Guideline 203

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): > 100 mg/l
Exposure time: 48 h
Method: OECD Test Guideline 202

Toxicity to algae/aquatic plants : EC50 (Selenastrum capricornutum (green algae)): > 100 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201

NOEC (Selenastrum capricornutum (green algae)): > 75 mg/l
Exposure time: 3 d
Method: OECD Test Guideline 201

**Persistence and degradability**

**Components:**

**Difluoromethane:**

Biodegradability : Result: Not readily biodegradable.
Method: OECD Test Guideline 301D

**2,3,3,3-Tetrafluoropropene:**

Biodegradability : Result: Not readily biodegradable.
Method: OECD Test Guideline 301F

**Bioaccumulative potential**

**Components:**

**Difluoromethane:**

Partition coefficient: n-octanol/water : log Pow: 0.714

**2,3,3,3-Tetrafluoropropene:**

Bioaccumulation : Remarks: Bioaccumulation is unlikely.

Partition coefficient: n-octanol/water : log Pow: 2 (25 °C)

**Mobility in soil**

No data available

**Other adverse effects**

No data available

## 13. DISPOSAL CONSIDERATIONS

**Disposal methods**

Waste from residues : Dispose of in accordance with local regulations.

Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.
Empty pressure vessels should be returned to the supplier.
Empty containers retain residue and can be dangerous.
Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury and/or death.
If not otherwise specified: Dispose of as unused product.

## 14. TRANSPORT INFORMATION

**International Regulations**

**UNRTDG**

| | | |
|---|---|---|
| UN number | : | UN 3161 |
| Proper shipping name | : | LIQUEFIED GAS, FLAMMABLE, N.O.S. (Difluoromethane, 2,3,3,3-Tetrafluoropropene) |
| Class | : | 2.1 |
| Packing group | : | Not assigned by regulation |
| Labels | : | 2.1 |

**IATA-DGR**

| | | |
|---|---|---|
| UN/ID No. | : | UN 3161 |
| Proper shipping name | : | Liquefied gas, flammable, n.o.s. (Difluoromethane, 2,3,3,3-Tetrafluoropropene) |
| Class | : | 2.1 |
| Packing group | : | Not assigned by regulation |
| Labels | : | Flammable Gas |
| Packing instruction (cargo aircraft) | : | 200 |
| Packing instruction (passenger aircraft) | : | Not permitted for transport |

**IMDG-Code**

| | | |
|---|---|---|
| UN number | : | UN 3161 |
| Proper shipping name | : | LIQUEFIED GAS, FLAMMABLE, N.O.S. (Difluoromethane, 2,3,3,3-Tetrafluoropropene) |
| Class | : | 2.1 |
| Packing group | : | Not assigned by regulation |
| Labels | : | 2.1 |
| EmS Code | : | F-D, S-U |
| Marine pollutant | : | no |

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**

Not applicable for product as supplied.

**Special precautions for user**

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

## 15. REGULATORY INFORMATION

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

| | | |
|---|---|---|
| Hazardous Substance Act | : | Conditions of restriction for the following entries should be considered:<br>HFC-32<br>(List 5.1, Number on list 429)<br>HFO-1234yf<br>(List 5.1, Number on list 494) |
| Emergency Decree on Controlling the Use of Volatile Substances | : | Not applicable |
| Montreal Protocol | : | Difluoromethane |

## 16. OTHER INFORMATION

Other information : Opteon™ and any associated logos are trademarks or copyrights of The Chemours Company FC, LLC.
Chemours™ and the Chemours Logo are trademarks of The Chemours Company.
Before use read Chemours safety information.
For further information contact the local Chemours office or nominated distributors.

**Further information**

Sources of key data used to compile the Safety Data Sheet : Internal technical data, data from raw material SDSs, OECD eChem Portal search results and European Chemicals Agency, http://echa.europa.eu/

Date format : yyyy/mm/dd

**Full text of other abbreviations**

AIIC - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is designed only as a guidance for

safe handling, use, processing, storage, transportation, disposal and release and shall not be considered a warranty or quality specification of any type. The information provided relates only to the specific material identified at the top of this SDS and may not be valid when the SDS material is used in combination with any other materials or in any process, unless specified in the text. Material users should review the information and recommendations in the specific context of their intended manner of handling, use, processing and storage, including an assessment of the appropriateness of the SDS material in the user's end product, if applicable.

TH / EN