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CVR No. DK 12 76 00 43

SAFETY DATA SHEET

DIETHYL MALEATE

Revision: Sections containing a revision or new information are marked with a ♣.

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

1.1. **Product identifier** ..... **Diethyl maleate**
CAS no. 141-05-9

1.2. **Relevant identified uses of the substance or mixture and uses advised against** ..... Chemical intermediate for use in closed system only.

1.3. **Details of the supplier of the safety data sheet**

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SDS.Ronland@fmc.com

1.4. **Emergency telephone number**
Company ..... +45 97 83 53 53 (24 h; for emergencies only)

Medical emergencies:
Austria: +43 1 406 43 43
Belgium: +32 70 245 245
Bulgaria: +359 2 9154 409
Cyprus: 1401
Czech Republic: +420 224 919 293
+420 224 915 402
Denmark: +45 82 12 12 12
England and Wales: 111
Estonia: +372 7943500
France: +33 (0) 1 45 42 59 59
Finland: +358 9 471 977
Greece: 30 210 77 93 777
Hungary: +36 80 20 11 99
Ireland (Republic): +353 1 837 9964
Italy: +39 02 6610 1029
Latvia: +371 670 42 473
112
Lithuania: +370 523 62052
+370 687 53378
Luxembourg: +352 8002 5500
Netherlands: +31 30 274 88 88
Norway: +47 22 591300
Poland: +48 22 619 66 54
+48 22 619 08 97
Portugal: 800 250 250 (in Portugal only)
+351 21 330 3284
Romania: +40 21318 3606
Scotland: +8454 24 24 24
Slovakia: +421 2 54 77 4 166
Slovenia: +386 41 650 500
South Africa: +27 83 123 3911 (Bateleur Emergency Response Co.)
Spain: +34 91 562 04 20
Sweden: +46 08-331231
112
Switzerland: 145
Turkey: 114
U.S.A. & Canada: +1 800 / 331 3148
All other countries: +1 651 / 632 6793 (Collect)

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SECTION 2: HAZARDS IDENTIFICATION

2.1. **Classification of the substance or mixture** ..... Sensitisation – skin: Category 1A (H317)

Health hazards ..... May cause allergic reactions.

Environmental hazards ..... May be harmful to aquatic organisms.

2.2. **Label elements**

According to EU Reg. 1272/2008 as amended

Product identifier ..... Diethyl maleate
CAS no. 141-05-9

Hazard pictogram (GHS07) .....

Signal word ..... Warning

Hazard statement
H317 ..... May cause an allergic skin reaction.

Precautionary statements
P261 ..... Avoid breathing vapours.
P280 ..... Wear protective gloves.
P302+P352 ..... IF ON SKIN: Wash with plenty of soap and water.
P333+P313 ..... If skin irritation or rash occurs: Get medical attention.
P362+P364 ..... Take off contaminated clothing and wash it before reuse.
P501 ..... Dispose of contents and container as hazardous waste.

2.3. **Other hazards** ..... The substance does not meet the criteria for being PBT or vPvB.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. **Substances**

CAS name ..... 2-Butenedioic acid (2Z)-, diethyl ester
CAS no. 141-05-9
IUPAC name/EU name ..... Diethyl maleate
EC no. (EINECS no.) 205-451-9
EU index no. ..... None
Registration no. 01-2119565138-34-0000

3.2. **Mixtures** ..... The product is a substance, not a mixture.

SECTION 4: FIRST AID MEASURES

4.1. **Description of first aid measures**

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Inhalation	If experiencing any discomfort, immediately remove from exposure. Light cases: Keep person under surveillance. Get medical attention immediately if symptoms develop. Serious cases: Get medical attention immediately or call for an ambulance.
Skin contact	Immediately remove contaminated clothing and footwear. Flush skin with water. Wash with water and soap. See physician immediately if any symptom develops.
Eye contact	Immediately rinse eyes with much water or eyewash solution, occasionally opening eyelids, until no evidence of chemical remains. Remove contact lenses after a few minutes and rinse again. See physician if irritation develops.
Ingestion	Let the exposed person rinse mouth and let him/her drink several glasses of water or milk, but not induce vomiting. If vomiting does occur, let him/her rinse mouth and drink fluids again. Get medical attention immediately.
4.2. **Most important symptoms and effects, both acute and delayed**	Allergic reactions.
4.3. **Indication of any immediate medical attention and special treatment needed**	Get medical attention immediately in case of ingestion. It may be helpful to show this safety data sheet to physician.
Notes to physician	A specific antidote to this chemical is not known. After ingestion, gastric lavage and administration of activated charcoal can be considered.

SECTION 5: FIRE-FIGHTING MEASURES

5.1. **Extinguishing media**	Dry chemical or carbon dioxide for small fires, water spray or foam for large fires. Avoid heavy hose streams.
5.2. **Special hazards arising from the substance or mixture**	The essential breakdown products are carbon monoxide and carbon dioxide.
5.3. **Advice for firefighters**	Use water spray to keep fire-exposed containers cool. Approach fire from upwind to avoid hazardous vapours and toxic decomposition products. Fight fire from protected location or maximum possible distance. Dike area to prevent water runoff. Firemen should wear self-contained breathing apparatus and protective clothing.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. **Personal precautions, protective equipment and emergency procedures**	It is recommended to have a predetermined plan for the handling of spills. Empty, sealable vessels for the collection of spills should be available.

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In case of large spill (involving 10 tonnes of the product or more):
1. use personal protection equipment; see section 8
2. call emergency telephone no.; see section 1
3. alert authorities.

Observe all safety precautions when cleaning up spills. Use personal protection equipment. Depending on the magnitude of the spill this may mean wearing respirator, face mask or eye protection, chemical resistant clothing, gloves and boots.

Stop the source of the spill immediately if safe to do so. Keep unprotected persons away from the spill area. Remove sources of ignition.

6.2. **Environmental precautions** .....

Contain the spill to prevent any further contamination of surface, soil or water. Wash waters must be prevented from entering surface water drains. Uncontrolled discharge into water courses must be alerted to the appropriate regulatory body.

6.3. **Methods and materials for containment and cleaning up**

It is recommended to consider possibilities to prevent damaging effects of spills, such as bunding or capping. See GHS (Annex 4, Section 6).

Use non-sparking tools and equipment. If appropriate, surface water drains should be covered. Minor spills on the floor or other impervious surface should be absorbed onto an absorptive material such as universal binder, hydrated lime, Fuller's earth or other absorbent clays. Collect the contaminated absorbent in suitable containers. Clean area with detergent and much water. The used containers should be properly closed and labelled.

Large spills which soak into the ground should be dug up and transferred to suitable containers.

Spills in water should be contained as much as possible by isolation of the contaminated water. The contaminated water must be collected and removed for treatment or disposal.

6.4. **Reference to other sections** .....

See subsection 8.2. for personal protection.
See section 13 for disposal.

SECTION 7: HANDLING AND STORAGE

7.1. **Precautions for safe handling** ....

The substance may be used in closed systems only.

Remove contaminated clothing immediately. Wash thoroughly after handling. After work, take off all work clothes and footwear. Take a shower, using water and soap. Wear only clean clothes when leaving job. Wash protective clothing and protective equipment with water and soap after each use.

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Do not discharge to the environment. Do not contaminate water when disposing of equipment wash waters. Collect all waste material and remains from cleaning equipment, etc., and dispose of as hazardous waste. See section 13 for disposal.

7.2. **Conditions for safe storage, including any incompatibilities**

Protect against extremes of cold and heat.

Store in closed, labelled containers. The storage room should be constructed of incombustible material, closed, dry, ventilated and with impermeable floor, without access of unauthorised persons or children. The room should only be used for storage of chemicals. Food, drink, feed and seed should not be present. A hand wash station should be available.

7.3. **Specific end use(s)** ..... The substance is meant for industrial uses in closed systems only.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. **Control parameters**

Personal exposure limits ..... To our knowledge, no exposure limits have been determined for diethyl maleate. However, exposure limits defined by local regulations may exist and must be observed.

Diethyl maleate

DNEL, PNEC ..... Chemical Safety Report not available.

8.2. **Exposure controls** ..... When used in a closed system, personal protection equipment will not be required. The following is meant for other situations, when the use of a closed system is not possible, or when it is necessary to open the system. Consider the need to render equipment or piping systems non-hazardous before opening.

Respiratory protection — In the event of an accidental discharge of the material which produces a heavy vapour or mist, workers must put on officially approved respiratory protection equipment with a universal filter type including particle filter.

Protective gloves ..... Wear chemical resistant gloves, such as barrier laminate, butyl rubber or nitrile rubber. The breakthrough times of these materials for the product are unknown. Generally, however, the use of protective gloves will give only partial protection against dermal exposure. Small tears in the gloves and cross-contamination can easily occur. It is recommended to replace the gloves frequently and to limit the work to be done manually.

Eye protection ..... Wear safety glasses. It is recommended to have an eye wash fountain immediately available in the workplace when there is a potential for eye contact.

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Other skin protection — Wear appropriate chemical resistant clothing to prevent skin contact depending on the extent of exposure. During most normal work situations where exposure to the material cannot be avoided for a limited time span, waterproof pants and apron of chemical resistant material or coveralls of polyethylene (PE) will be sufficient. Coveralls of PE must be discarded after use if contaminated. In cases of excessive or prolonged exposure, coveralls of barrier laminate may be required.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. **Information on physical and chemical properties**

Appearance	Colourless liquid
Odour	Aromatic
Odour threshold	Not determined
pH	Not determined
Melting point/freezing point	< -22°C
Initial boiling point and boiling range	225°C
Flash point	105°C (closed cup)
Evaporation rate	Not determined
Flammability (solid/gas)	Not applicable (liquid)
Upper/lower flammability or explosive limits	1.1 - 7.7 vol% (≈ 1.1 - 7.7 kPa)
Vapour pressure	0.29 Pa at 30°C
Vapour density	Not determined
Relative density	1.07 at 23°C
Solubility(ies)	Slightly soluble in ethanol and ether, soluble in aliphatic solvents Solubility in water: 15 g/l at 20°C
Partition coefficient n-octanol/water	Not determined; log K_{ow} = 1.7 at 25°C by model calculation
Autoignition temperature	295°C
Decomposition temperature	Not determined
Viscosity	3.1 mPa.s at 25°C
Explosive properties	Not explosive
Oxidising properties	Not oxidising

9.2. **Other information** ..... No more relevant information is available.

SECTION 10: STABILITY AND REACTIVITY

10.1. **Reactivity** ..... To our knowledge, the product has no special reactivities.

10.2. **Chemical stability** ..... The product is stable during normal handling and storage at ambient temperatures.

10.3. **Possibility of hazardous reactions** None known.

10.4. **Conditions to avoid** ..... Heating of the product will produce harmful and irritant vapours.

10.5. **Incompatible materials** ..... None known.

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10.6. **Hazardous decomposition products** See subsection 5.2.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. **Information on toxicological effects** * = Based on available data, the classification criteria are not met.

Diethyl maleate

Toxicokinetics, metabolism and distribution		After oral intake, diethyl maleate is readily absorbed in the body. It has an effect on liver and renal functions.
Acute toxicity		The substance is not considered as harmful by single exposures. * The acute toxicity is measured as:
Route(s) of entry	- ingestion	LD_{50}, oral, rat: > 3200 mg/kg
	- skin	LD_{50}, dermal, rat: approx. 5000 mg/kg
	- inhalation	LC_{50}, inhalation, rat: no deaths at saturated vapour pressure for 8 hours
Skin corrosion/irritation		Not irritating to skin (method OECD 404). *
Serious eye damage/irritation		Slightly irritating to eyes (method OECD 405. *
Respiratory or skin sensitisation ...		Allergic skin sensitizer (method OECD 406 and 429).
Germ cell mutagenicity		Ames test negative (method OECD 471). *
Carcinogenicity		No information is available.
Reproductive toxicity		Reduced number of germ cells was observed in mice after peritoneal administration of diethyl maleate for two weeks. *
STOT – single exposure		Vapours may have narcotic effects at high doses. *
STOT – repeated exposure		No information is available. Organic solvents generally are suspected to cause irreversible damage to the nervous system on repeated exposure. *
Aspiration hazard		The substance is not of a type which is known to pose an aspiration hazard. *
Symptoms and effects, acute and delayed		Allergic reactions.

SECTION 12: ECOLOGICAL INFORMATION

12.1. **Toxicity** ..... The substance may be harmful to fish and daphnids.

The acute ecotoxicity of **diethyl maleate** is measured as:

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- Fish	Fathead minnow (*Pimephales promelas*)	96-h LC_{50}: 18 mg/l
- Invertebrates	Daphnids (*Daphnia magna*)	48-h EC_{50}: 53 mg/l
- Algae	Green algae (*Pseudokirchneriella subcapitata*)	72-h EC_{50}: 202 mg/l

12.2. **Persistence and degradability** .... The substance is readily biodegradable.

12.3. **Bioaccumulative potential** ..... Bioaccumulation is not expected.

12.4. **Mobility in soil** ..... The substance has a potentially high mobility in soil, but is relatively unstable.

12.5. **Results of PBT and vPvB assessment** ..... The substance does not meet the criteria for being PBT or vPvB.

12.6. **Other adverse effects** ..... Other relevant hazardous effects in the environment are not known.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. **Waste treatment methods** ..... Remaining quantities of the material and empty but unclean packaging should be regarded as hazardous waste.

Disposal of waste and packagings must always be in accordance with all applicable local regulations.

Disposal of product ..... According to the Waste Framework Directive (2008/98/EC), possibilities for reuse or reprocessing should first be considered. If this is not possible, the material can be disposed of by removal to a licensed chemical destruction plant or by controlled incineration with flue gas scrubbing.

Do not contaminate water, foodstuffs, feed or seed by storage or disposal. Do not discharge to sewer systems.

Disposal of packaging ..... It is recommended to consider possible ways of disposal in the following order:
1. Reuse or recycling should first be considered. If offered for recycling, containers must be emptied and triply rinsed (or equivalent). Do not discharge rinsing water to sewer systems.
2. Controlled incineration with flue gas scrubbing is possible for combustible packaging materials.
3. Delivery of the packaging to a licensed service for disposal of hazardous waste.
4. Disposal in a landfill or burning in open air should only occur as a last resort. For disposal in a landfill, containers should be emptied completely, rinsed and punctured to make them unusable for other purposes. If burned, stay out of smoke.

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SECTION 14: TRANSPORT INFORMATION

ADR/RID/IMDG/IATA/ICAO classification

14.1. **UN number** ..... Not classified as hazardous material for transport

14.2. **UN proper shipping name** ..... Not applicable

14.3. **Transport hazard class(es)** ..... Not applicable

14.4. **Packing group** ..... Not applicable

14.5. **Environmental hazards** ..... The substance may be harmful in the aquatic environment.

14.6. **Special precautions for user** ..... Avoid any unnecessary contact with the product. Misuse can result in damage to health. Do not discharge to the environment.

14.7. **Transport in bulk according to Annex II of MARPOL and the IBC code** ..... The product is not transported in bulk by ship.

SECTION 15: REGULATORY INFORMATION

15.1. **Safety, health and environmental regulations/legislation specific for the substance or mixture** To our knowledge, no specific regulations apply.

The substance is covered by EU chemical legislation.

15.2. **Chemical safety assessment** ..... A chemical safety assessment is not available.

♣ SECTION 16: OTHER INFORMATION

Relevant changes in the safety data sheet ..... Minor corrections only.

List of abbreviations .....

CAS	Chemical Abstracts Service
Dir.	Directive
DNEL	Derived No Effect Level
EC	European Community
EC_{50}	50% Effect Concentration
ECHA	European CHemicals Agency
EINECS	European INventory of Existing Commercial Chemical Substances
GHS	Globally Harmonized classification and labelling System of chemicals, Fifth revised edition 2013
IBC	International Bulk Chemical code
IUPAC	International Union of Pure and Applied Chemistry
LC_{50}	50% Lethal Concentration
LD_{50}	50% Lethal Dose
MARPOL	Set of rules from the International Maritime Organisation (IMO) for prevention of sea pollution

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OECD	Organisation for Economic Cooperation and Development
PBT	Persistent, Bioaccumulative, Toxic
PNEC	Predicted No Effect Concentration
Reg.	Regulation
STOT	Specific Target Organ Toxicity
vPvB	very Persistent, very Bioaccumulative

References ..... Data are available from published literature and can be found several places.

Method for classification ..... Classification and Labelling Inventory (ECHA)

Used hazard statement ..... H317 May cause an allergic skin reaction.

Advice on training ..... This material should only be used by persons who are made aware of its hazardous properties and have been instructed in the required safety precautions.

The information provided in this safety data sheet is believed to be accurate and reliable, but uses of the product vary and situations unforeseen by FMC Corporation may exist. The user has to check the validity of the information under local circumstances.

Prepared by: FMC Agricultural Solutions A/S / GHB