



SAFETY DATA SHEET

Methylcyclopentadienylmanganese tricarbonyl

According to the REACH etc. (Amendment etc.) (EU Exit) Regulations 2020 No. 1577, as amended.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name	Methylcyclopentadienylmanganese tricarbonyl
Chemical name	(Methylcyclopentadienyl)tricarbonylmanganese
Synonyms; trade names	MCMT, Tricarbonyl(2-methylcyclopentadienyl)manganese, Ethyl MMT, MMT, NSC 22316
CAS number	12108-13-3
EC number	235-166-5

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

Identified uses	Research and development. Industrial use
Uses advised against	Not suitable for human consumption or veterinary purposes.

1.3. Details of the supplier of the safety data sheet

Supplier	Molekula Ltd. Lingfield Way, Darlington, DL1 4XX, United Kingdom +44 (0) 3302000333 info@molekula.com
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1.4. Emergency telephone number

+44 (0) 7769276927

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (SI 2019 No. 720)

Physical hazards	Not Classified
Health hazards	Acute Tox. 3 - H301 Acute Tox. 2 - H310 Acute Tox. 1 - H330 Skin Irrit. 2 - H315 Eye Irrit. 2 - H319 STOT SE 3 - H335 STOT RE 1 - H372
Environmental hazards	Aquatic Acute 1 - H400 Aquatic Chronic 1 - H410

2.2. Label elements

EC number	235-166-5
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Hazard pictograms



Signal word

Danger

Methylcyclopentadienylmanganese tricarbonyl

Hazard statements	<p>H301 Toxic if swallowed.</p> <p>H310+H330 Fatal in contact with skin or if inhaled.</p> <p>H315 Causes skin irritation.</p> <p>H319 Causes serious eye irritation.</p> <p>H335 May cause respiratory irritation.</p> <p>H372 Causes damage to organs (Respiratory system, lungs) through prolonged or repeated exposure.</p> <p>H410 Very toxic to aquatic life with long lasting effects.</p>
Precautionary statements	<p>P260 Do not breathe vapour/ spray.</p> <p>P262 Do not get in eyes, on skin, or on clothing.</p> <p>P264 Wash contaminated skin thoroughly after handling.</p> <p>P271 Use only outdoors or in a well-ventilated area.</p> <p>P273 Avoid release to the environment.</p> <p>P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.</p> <p>P284 Wear respiratory protection.</p> <p>P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/ doctor.</p> <p>P302+P352 IF ON SKIN: Wash with plenty of water.</p> <p>P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.</p> <p>P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.</p> <p>P312 Call a POISON CENTRE/doctor if you feel unwell.</p> <p>P330 Rinse mouth.</p> <p>P332+P313 If skin irritation occurs: Get medical advice/ attention.</p> <p>P337+P313 If eye irritation persists: Get medical advice/ attention.</p> <p>P361+P364 Take off immediately all contaminated clothing and wash it before reuse.</p> <p>P362+P364 Take off contaminated clothing and wash it before reuse.</p> <p>P391 Collect spillage.</p> <p>P403+P233 Store in a well-ventilated place. Keep container tightly closed.</p> <p>P405 Store locked up.</p> <p>P501 Dispose of contents/ container in accordance with national regulations.</p>

2.3. Other hazards

This substance is not classified as PBT or vPvB according to current UK criteria.

SECTION 3: Composition/information on ingredients

3.1. Substances

Product name	Methylcyclopentadienylmanganese tricarbonyl
Chemical name	(Methylcyclopentadienyl)tricarbonylmanganese
CAS number	12108-13-3
EC number	235-166-5
Chemical formula	CH ₃ C ₅ H ₄ Mn(CO) ₃

SECTION 4: First aid measures

4.1. Description of first aid measures

General information	Get medical attention if any discomfort continues. Show this Safety Data Sheet to the medical personnel.
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Inhalation	Move affected person to fresh air and keep warm and at rest in a position comfortable for breathing. Maintain an open airway. Loosen tight clothing such as collar, tie or belt. When breathing is difficult, properly trained personnel may assist affected person by administering oxygen. Get medical attention. Place unconscious person on their side in the recovery position and ensure breathing can take place.
Ingestion	Get medical attention immediately. Rinse mouth thoroughly with water. Give a few small glasses of water or milk to drink. Stop if the affected person feels sick as vomiting may be dangerous. Never give anything by mouth to an unconscious person. Place unconscious person on their side in the recovery position and ensure breathing can take place. Keep affected person under observation.
Skin contact	It is important to remove the substance from the skin immediately. Remove contamination with soap and water or recognised skin cleansing agent. Get medical attention.
Eye contact	Rinse with water. Do not rub eye. Remove any contact lenses and open eyelids wide apart. Get medical attention if any discomfort continues.
Protection of first aiders	It may be dangerous for first aid personnel to carry out mouth-to-mouth resuscitation.

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

General information	The severity of the symptoms described will vary dependent on the concentration and the length of exposure.
Inhalation	A single exposure may cause the following adverse effects: Difficulty in breathing. Unconsciousness, possibly death.
Ingestion	May cause stomach pain or vomiting. May cause severe internal injury.
Skin contact	A single exposure may cause the following adverse effects: Pain. Unconsciousness, possibly death.
Eye contact	Irritating to eyes.

4.3. Indication of any immediate medical attention and special treatment needed

Notes for the doctor	Treat symptomatically. Keep affected person under observation.
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SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog. Use fire-extinguishing media suitable for the surrounding fire.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture

Specific hazards	Containers can burst violently or explode when heated, due to excessive pressure build-up. This product is toxic.
Hazardous combustion products	Thermal decomposition or combustion products may include the following substances: Very toxic or corrosive gases or vapours. Carbon monoxide (CO). Carbon dioxide (CO ₂). Oxides of the following substances: Manganese.

5.3. Advice for firefighters

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Protective actions during firefighting	Avoid breathing fire gases or vapours. Evacuate area. Keep upwind to avoid inhalation of gases, vapours, fumes and smoke. Ventilate closed spaces before entering them. Cool containers exposed to heat with water spray and remove them from the fire area if it can be done without risk. Cool containers exposed to flames with water until well after the fire is out. If a leak or spill has not ignited, use water spray to disperse vapours and protect men stopping the leak. Avoid discharge to the aquatic environment. Control run-off water by containing and keeping it out of sewers and watercourses. If risk of water pollution occurs, notify appropriate authorities.
Special protective equipment for firefighters	Wear chemical protective suit. Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing. Firefighter's clothing will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions	Wear protective clothing as described in Section 8 of this safety data sheet. No action shall be taken without appropriate training or involving any personal risk. Do not touch or walk into spilled material. Avoid inhalation of vapours and spray/mists. Use suitable respiratory protection if ventilation is inadequate. Avoid contact with skin and eyes.
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6.2. Environmental precautions

Environmental precautions	Avoid discharge into drains or watercourses or onto the ground. Avoid discharge to the aquatic environment.
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6.3. Methods and material for containment and cleaning up

Methods for cleaning up	Wear protective clothing as described in Section 8 of this safety data sheet. Clear up spills immediately and dispose of waste safely. Provide adequate ventilation. Small Spillages: Collect spillage. Large Spillages: Absorb spillage with non-combustible, absorbent material. The contaminated absorbent may pose the same hazard as the spilled material. Collect and place in suitable waste disposal containers and seal securely. Label the containers containing waste and contaminated materials and remove from the area as soon as possible. Flush contaminated area with plenty of water. Wash thoroughly after dealing with a spillage. Dangerous for the environment. Do not empty into drains. For waste disposal, see Section 13.
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6.4. Reference to other sections

Reference to other sections	For personal protection, see Section 8. See Section 11 for additional information on health hazards. See Section 12 for additional information on ecological hazards. For waste disposal, see Section 13.
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SECTION 7: Handling and storage

7.1. Precautions for safe handling

Usage precautions	Read and follow manufacturer's recommendations. Wear protective clothing as described in Section 8 of this safety data sheet. Keep away from food, drink and animal feeding stuffs. Handle all packages and containers carefully to minimise spills. Keep container tightly sealed when not in use. Avoid the formation of mists. This product is toxic. Immediate first aid is imperative. Avoid discharge to the aquatic environment. Do not handle until all safety precautions have been read and understood. Do not handle broken packages without protective equipment. Do not reuse empty containers.
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Advice on general occupational hygiene	Wash promptly if skin becomes contaminated. Take off contaminated clothing. Wash contaminated clothing before reuse.
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7.2. Conditions for safe storage, including any incompatibilities

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Storage precautions

Store away from incompatible materials (see Section 10). Store locked up. Keep only in the original container. Keep container tightly closed, in a cool, well ventilated place. Keep containers upright. Protect containers from damage.

Air sensitive. Store under inert gas.

Storage class

Toxic storage.

7.3. Specific end use(s)

Specific end use(s)

The identified uses for this product are detailed in Section 1.2.

SECTION 8: Exposure controls/Personal protection

8.1. Control parameters

Occupational exposure limits

ACGIH, TLV: 0.2 mg/m³

OSHA PEL, TWA: 0.2 mg/m³

NIOSH IDLH, 500 mg/m³

, TWA: 0.2 mg/m³

, STEL: 3 mg/m³

Mexico OEL, TWA: 0.2 mg/m³

8.2. Exposure controls

Protective equipment



Appropriate engineering controls

Use process enclosures, local exhaust ventilation or other engineering controls as the primary means to minimise worker exposure. Ensure the ventilation system is regularly maintained and tested. In case of insufficient ventilation, wear suitable respiratory equipment. Observe any occupational exposure limits for the product or ingredients.

Eye/face protection

Wear tight-fitting, chemical splash goggles or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Hand protection

For exposure up to 8 hours, wear gloves made of the following material: Nitrile rubber. Thickness: ≥ 0.4mm mm

The most suitable glove should be chosen in consultation with the glove supplier/manufacturer, who can provide information about the breakthrough time of the glove material. To protect hands from chemicals, wear gloves that are proven to be impervious to the chemical and resist degradation. Considering the data specified by the glove manufacturer, check during use that the gloves are retaining their protective properties and change them as soon as any deterioration is detected. Frequent changes are recommended.

Other skin and body protection

Wear appropriate clothing to prevent any possibility of skin contact.

Hygiene measures

Wash after use and before eating, smoking and using the toilet. Do not eat, drink or smoke when using this product.

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Respiratory protection	Ensure all respiratory protective equipment is suitable for its intended use and is 'UKCA'-marked. Check that the respirator fits tightly and the filter is changed regularly. Gas and combination filter cartridges suitable for intended use should be used. Full face mask respirators with replaceable filter cartridges suitable for intended use should be used. Half mask and quarter mask respirators with replaceable filter cartridges suitable for intended use should be used.
Environmental exposure controls	Keep container tightly sealed when not in use. Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Viscous liquid.
Colour	Yellow. Orange.
Odour	Not known.
Odour threshold	No information available.
pH	No information available.
Melting point	-1°C/30.2°F
Initial boiling point and range	232 - 233°C/449.6 - 451.4°F @ 760 mm Hg
Flash point	96°C/204.8°F Closed cup.
Evaporation rate	No information available.
Flammability (solid, gas)	No information available.
Upper/lower flammability or explosive limits	No information available.
Vapour pressure	0.07 hPa @ 20°C/68°F
Vapour density	7.53
Relative density	1.38
Solubility(ies)	Insoluble in water. Soluble in the following materials: Acetone. Ether. Hydrocarbons.
Partition coefficient	No information available.
Auto-ignition temperature	No information available.
Decomposition Temperature	No information available.

9.2. Other information

Refractive index	1.5873
Molecular weight	218.09

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity	See the other subsections of this section for further details.
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10.2. Chemical stability

Methylcyclopentadienylmanganese tricarbonyl

Stability Stable at normal ambient temperatures and when used as recommended. Stable under the prescribed storage conditions.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions No potentially hazardous reactions known.

10.4. Conditions to avoid

Conditions to avoid Protect from moisture.

10.5. Incompatible materials

Materials to avoid Halogenated Compounds Oxidising agents.

10.6. Hazardous decomposition products

Hazardous decomposition products Does not decompose when used and stored as recommended. Thermal decomposition or combustion products may include the following substances: Toxic gases or vapours. Carbon monoxide (CO). Carbon dioxide (CO₂). Oxides of: Manganese.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity - oral

Summary Toxic if swallowed.

Acute toxicity oral (LD₅₀ mg/kg) 58.0

Species Rat

ATE oral (mg/kg) 58.0

Acute toxicity - dermal

Summary Fatal in contact with skin.

Acute toxicity dermal (LD₅₀ mg/kg) 196.7

Species Rabbit

ATE dermal (mg/kg) 196.7

Acute toxicity - inhalation

Summary Fatal if inhaled.

Acute toxicity inhalation (LC₅₀ vapours mg/l) 0.07

Species Rat

ATE inhalation (vapours mg/l) 0.07

Skin corrosion/irritation

Summary Causes skin irritation.

Serious eye damage/irritation

Summary Causes serious eye irritation.

Respiratory sensitisation

Summary Based on available data the classification criteria are not met.

Skin sensitisation

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Summary	Based on available data the classification criteria are not met.
<u>Germ cell mutagenicity</u>	
Summary	Based on available data the classification criteria are not met.
<u>Carcinogenicity</u>	
Summary	Based on available data the classification criteria are not met.
IARC carcinogenicity	None of the ingredients are listed or exempt.
<u>Reproductive toxicity</u>	
Summary	Based on available data the classification criteria are not met.
<u>Specific target organ toxicity - single exposure</u>	
Summary	May cause respiratory irritation.
Target organs	Respiratory system, lungs
<u>Specific target organ toxicity - repeated exposure</u>	
Summary	Causes damage to organs through prolonged or repeated exposure.
<u>Aspiration hazard</u>	
Summary	Based on available data the classification criteria are not met.
General information	The severity of the symptoms described will vary dependent on the concentration and the length of exposure.
Inhalation	A single exposure may cause the following adverse effects: Difficulty in breathing. Unconsciousness, possibly death.
Ingestion	May cause stomach pain or vomiting. May cause severe internal injury.
Skin contact	A single exposure may cause the following adverse effects: Pain. Unconsciousness, possibly death.
Eye contact	Irritating to eyes.
Route of exposure	Ingestion Inhalation Skin and/or eye contact
Target organs	Respiratory system, lungs

SECTION 12: Ecological information

12.1. Toxicity

<u>Acute aquatic toxicity</u>	
Summary	Very toxic to aquatic life.
LE(C)₅₀	$0.1 < L(E)C_{50} \leq 1$
M factor (Acute)	1
Acute toxicity - fish	LC ₅₀ , 96 hours: 0.21 mg/l, Cyprinus carpio (Common carp)
Acute toxicity - aquatic invertebrates	EC ₅₀ , 48 hours: 0.83 mg/l, Daphnia magna

Chronic aquatic toxicity

Summary	Very toxic to aquatic life with long lasting effects.
M factor (Chronic)	1

12.2. Persistence and degradability

Methylcyclopentadienylmanganese tricarbonyl

Persistence and degradability 4%, 56 days Not readily biodegradable.

12.3. Bioaccumulative potential

Bioaccumulative potential No data available on bioaccumulation.

Partition coefficient No information available.

12.4. Mobility in soil

Mobility No data available.

12.5. Results of PBT and vPvB assessment

12.6. Other adverse effects

Other adverse effects None known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

General information The generation of waste should be minimised or avoided wherever possible. Reuse or recycle products wherever possible. This material and its container must be disposed of in a safe way. When handling waste, the safety precautions applying to handling of the product should be considered. Care should be taken when handling emptied containers that have not been thoroughly cleaned or rinsed out. Empty containers or liners may retain some product residues and hence be potentially hazardous.

Disposal methods Do not empty into drains. Dispose of surplus products and those that cannot be recycled via a licensed waste disposal contractor. Waste, residues, empty containers, discarded work clothes and contaminated cleaning materials should be collected in designated containers, labelled with their contents. Incineration or landfill should only be considered when recycling is not feasible.

SECTION 14: Transport information

General For limited quantity packaging/limited load information, consult the relevant modal documentation using the data shown in this section.

14.1. UN number

UN No. (ADR/RID) 3281

UN No. (IMDG) 3281

UN No. (ICAO) 3281

UN No. (ADN) 3281

14.2. UN proper shipping name

Proper shipping name (ADR/RID) METAL CARBONYLS, LIQUID, N.O.S. (Methylcyclopentadienylmanganese tricarbonyl)

Proper shipping name (IMDG) METAL CARBONYLS, LIQUID, N.O.S. (Methylcyclopentadienylmanganese tricarbonyl)

Proper shipping name (ICAO) METAL CARBONYLS, LIQUID, N.O.S. (Methylcyclopentadienylmanganese tricarbonyl)

Proper shipping name (ADN) METAL CARBONYLS, LIQUID, N.O.S. (Methylcyclopentadienylmanganese tricarbonyl)

14.3. Transport hazard class(es)

ADR/RID class 6.1

ADR/RID classification code T3

ADR/RID label 6.1

Methylcyclopentadienylmanganese tricarbonyl

IMDG class 6.1

ICAO class/division 6.1

ADN class 6.1

Transport labels



14.4. Packing group

ADR/RID packing group I

IMDG packing group I

ICAO packing group I

ADN packing group I

14.5. Environmental hazards

Environmentally hazardous substance/marine pollutant



14.6. Special precautions for user

Always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

EmS F-A, S-A

ADR transport category 1

Emergency Action Code 2X

Hazard Identification Number 66
(ADR/RID)

Tunnel restriction code (C/E)

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

Transport in bulk according to Not applicable.

Annex II of MARPOL 73/78
and the IBC Code

SECTION 15: Regulatory information

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

National regulations Health and Safety at Work etc. Act 1974 (as amended).
The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment
Regulations 2009 (SI 2009 No. 1348) (as amended) ["CDG 2009"].
EH40/2005 Workplace exposure limits.

15.2. Chemical safety assessment

No chemical safety assessment has been carried out.

Inventories

Methylcyclopentadienylmanganese tricarbonyl

EU - EINECS/ELINCS

None of the ingredients are listed or exempt.

SECTION 16: Other information

Abbreviations and acronyms used in the safety data sheet	<p>ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.</p> <p>ADN: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways.</p> <p>RID: European Agreement concerning the International Carriage of Dangerous Goods by Rail.</p> <p>IATA: International Air Transport Association.</p> <p>ICAO: Technical Instructions for the Safe Transport of Dangerous Goods by Air.</p> <p>IMDG: International Maritime Dangerous Goods.</p> <p>CAS: Chemical Abstracts Service.</p> <p>ATE: Acute Toxicity Estimate.</p> <p>LC50: Lethal Concentration to 50 % of a test population.</p> <p>LD50: Lethal Dose to 50% of a test population (Median Lethal Dose).</p> <p>EC₅₀: 50% of maximal Effective Concentration.</p> <p>PBT: Persistent, Bioaccumulative and Toxic substance.</p> <p>vPvB: Very Persistent and Very Bioaccumulative.</p>
Classification abbreviations and acronyms	<p>Acute Tox. = Acute toxicity</p> <p>Eye Irrit. = Eye irritation</p> <p>Skin Irrit. = Skin irritation</p> <p>STOT RE = Specific target organ toxicity-repeated exposure</p> <p>STOT SE = Specific target organ toxicity-single exposure</p> <p>Aquatic Acute = Hazardous to the aquatic environment (acute)</p> <p>Aquatic Chronic = Hazardous to the aquatic environment (chronic)</p>
Classification procedures according to SI 2019 No. 720	<p>Acute Tox. 1 - H330: Acute Tox. 2 - H310: Acute Tox. 3 - H301: STOT RE 1 - H372: STOT SE 3 - H335: Skin Irrit. 2 - H315: Eye Irrit. 2 - H319: : Expert judgement. Aquatic Acute 1 - H400: Aquatic Chronic 1 - H410: : Expert judgement.</p>
Training advice	Only trained personnel should use this material.
Revision date	26/08/2022
Revision	1
SDS number	1401
Hazard statements in full	<p>H301 Toxic if swallowed.</p> <p>H310 Fatal in contact with skin.</p> <p>H315 Causes skin irritation.</p> <p>H319 Causes serious eye irritation.</p> <p>H330 Fatal if inhaled.</p> <p>H335 May cause respiratory irritation.</p> <p>H372 Causes damage to organs (Respiratory system, lungs) through prolonged or repeated exposure.</p> <p>H400 Very toxic to aquatic life.</p> <p>H410 Very toxic to aquatic life with long lasting effects.</p>

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty, guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.