| | MATERIAL SAFETY DATASHEET | MSDS No. | M-02 |
|---|---|---|---|
| BloomchemAG | METHYL METHACRYLATE | Effective From | 10/04/2023 |

## Section 1 Identification of the substance/mixture and of the company/undertaking

### 1.1 Product identifier:

| | |
|---|---|
| Identification on the label/Trade name: | METHYL METHACRYLATE |
| Additional identification: | methyl 2-methylprop-2-enoate, methyl 2-methylpropenoate |
| Identification of the product: | CAS#80-62-6 EC#201-297-1 |
| Index Number: | 607-035-00-6 |
| REACH registration No.: | 01-2119452498-28-xxxx |

**1.2 Relevant identified uses of the substance and uses advised against:**

**1.2.1 Identified uses:**

Use in production of formulation

End use as a monomer in formulationsUse asan intermediate

End use as monomer in a dry polymerisation process(sheets)

End use as monomer in a dry polymerisation process (substance polymerisation, solvent polymerisation)End useas monomer in a wet polymerisation process (emulsion polymerisation,)

End use as monomer in a wet polymerisation process (suspension polymerisation, bead polymerisation)Polymerprocessing

Polymer uses; Industrial end use in formulationsProfessional end use in formulations

Polymer uses; Professional end use in formulationsConsumer enduse in formulations

Polymer uses; Consumer end use in formulations

Polymer uses; Consumer end use as polymer and service life

**1.2.2 Uses advised against:**

Not available.

### 1.3 Details of the supplier of the safety data sheet:

| | |
|---|---|
| Supplier: | Bloomchemag BV |
| Address | Sint - Antoniusstraat 16 b1, B-2400 Mol, Belgium. |
| Phone No. | +91 72919 74484 |
| E-mail | info@bloomchemag.com |

## Section 2 Hazards Identification

### 2.1 Classification of the substance/mixture

#### 2.1.1 Classification:

The substance is classified as following according to REGULATION (EC) No 1272/2008:

| **REGULATION (EC) No 1272/2008** | |
|---|---|
| Hazard classes/Hazard categories | Hazard statement |
| Flam. Liq. 2 | H225 |
| Skin Irrit. 2 | H315 |
| Skin Sens. 1 | H317 |
| STOT SE 3 | H335 |

*For full text of H- phrases: see section 2.2.*

### 2.2 label elements

**Hazard Pictograms:**

**Signal Word(S):** Danger

**Hazard Statement:**

H225: Highly flammable liquid and vapourH315: Causes skin irritation
H317: May cause an allergic skin reaction
H335: May cause respiratory irritation

**Precautionary statement**

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.
P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P264: Wash 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.P302 + P352: IF ON SKIN: Wash with plenty of water.
P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminatedclothing. Rinse skin with water/ shower.
P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable forbreathing.
P312: Call a POISON CENTER/ doctor if you feel unwell.
P332 + P313: If skin irritation occurs: Get medical advice/attention.
P333 + P313: If skin irritation or rash occurs: Get medical advice/ attention.
P362 + P364: Take off contaminated clothing and wash it before reuse.
P370 + P378: In case of fire: Use foam, dry chemical, carbon dioxide to extinguish.
P403 + P233: Store in a well-ventilated place. Keep container tightly closed.
P403 + P235: Store in a well-ventilated place. Keep cool.
P405: Store locked up.

P501: Dispose of contents/container in accordance with local regulation.

### 2.3 Other hazards

The substance is not considered a PBT/vPvB.

## Section 3 Composition/information on ingredients

**Substance/Mixture:** Substance

**Ingredient(s):**

| Chemical Name | Registration No. | CAS No. | EC No. | Concentration |
|---|---|---|---|---|
| methyl methacrylate | 01-2119452498-28-xxxx | 80-62-6 | 201-297-1 | 99.97796 %(w/w) |

## Section 4 First aid measures

### 4.1 Description of first aid measures:

In all cases of doubt, or when symptoms persist, seek medical attention.

**4.1.1 In case of inhalation:**

Move subject to fresh air and keep him calm. See a physician.

**4.1.2 In case of skin contact:**

Wash off immediately with soap and water. If skin irritation occurs consult a physician.

**4.1.3 In case of eyes contact:**

Keeping the eyelids apart flush thoroughly with water immediately. If irritation persists, contact a physician.

**4.1.4 In case of ingestion:**

Do not induce vomiting. Contact a doctor immediately.

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

Causes skin irritation. May cause an allergic skin reaction. May cause respiratory irritation.

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

If skin irritation or rash occurs, get medical advice/attention.

## Section 5 Fire-Fighting measures

### 5.1 Extinguishing media:

**Suitable extinguishing media:** Foam, dry chemical, carbon dioxide.

**Unsuitable extinguishing media:** Water.

**5.2 Special hazards arising from the substance or mixture** Highly flammable liquid and vapour.

**5.3 Special fire fighting methods and special protective actions for fire-fighters:** Firefighters must wear fire resistant protective equipment. Wear approved respiratorand protective gloves.

## Section 6 Accidental release measures

### 6.1 Personal precautions, protective equipment and emergency procedures:

**6.1.1 For non-emergency personnel:** Take care for adequate ventilation. Use personal protective clothing. Keep away sources of ignition. Use breathing apparatus if exposed to vapours/dust/mist/ aerosol.

**6.1.2 For emergency responders:** Wear an appropriate NIOSH/MSHA approved respirator if vapor is generated.

**6.2 Environmental Precautions:** Prevent product from getting into drains/surface water/groundwater.

**6.3 Methods for Containment and Cleaning up:** Larger quantities: Remove mechanically (by pumping). Use explosion-proof equipment! Smaller quantities and/or residues: Contain with absorbent material (e.g. sand, diatomaceous earth, acid absorbent, universal absorbent or sawdust). Dispose of in accordance with regulations.

**6.4 Reference to other sections:** See Section 7 for information on safe handling. See Section 8 for information on personal protection equipment.See Section 13 for information on disposal.

## Section 7 Handling and storage

**7.1 Precautions for safe handling:**

**7.1.1 Protective measures:** Keep container tightly closed. Ensure the area is well ventilated. Keep away from sources of ignition --- No smoking. Take precautionary measures against static discharges In the event of fire, cool the endangered containers with water. When heated above the flash point and/or during spraying (atomizing), ignitable mixtures may form in air. Use explosion-proof equipment only.

**7.1.2 Advice on general occupational hygiene:** Do not eat, drink and smoke in work areas. Wash hands after use. Remove contaminated clothing and protective equipment before entering eating areas.

**7.2 Conditions for safe storage, including any incompatibilities:** Keep only in the original container at a temperature not exceeding 30 °C. Protect fromlight. Fill the container by approximately 90 % only as oxygen (air) is required for stabilization. With large storage containers make sure the oxygen (air) supply is sufficient to ensure stability. Can polymerize with intense heat release.

**7.3 Specific end use(s):** Not applicable.

## Section 8 Exposure Controls/Personal Protection

**8.1 Control parameters:**

**8.1.1 Occupational exposure limits:** Not available

| Substance | | | Occupational Exposure Limit Value (8-hour reference period) | | Occupational Exposure Limit Value (15-minute reference period | | |
|---|---|---|---|---|---|---|---|
| | EINECS No. | CAS No. | ppm | mg/ m3 | ppm | mg/ m3 | Notes |
| Methyl methacrylate | 201-297-1 | 80-62-6 | 50 | - | 100 | - | - |

**8.1.2 Additional exposure limits under the conditions of use:** Not available

**8.1.3 DNEL/DMEL and PNEC-Values:**

DN(M)ELs for workers

| Exposure pattern | Route | Descriptor | DNEL / DMEL | (Corrected) Dose descriptor *) | Most sensitive endpoint | Justification |
|---|---|---|---|---|---|---|
| Acute - systemic effects | Dermal | | | | | Single dermal doses of MMA caused no other effects than dermal irritation. An acute dermal DNEL for systemic effects is not necessary. |
| Acute - systemic effects | Inhalation | | | | | The critical health effect is irritation in the upper respiratory tract. The |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | chronic DNEL will be protective against this endpoint. |
| Acute - local effects | Dermal | DNEL (Derived No Effect Level) | 1.5 mg/cm² | : 15.0 mg/cm² (based on AF of 10) | sensitisation (skin) | See discussion |
| Acute - local effects | Inhalation | DNEL (Derived No Effect Level) | 416 mg/m³ | : 416 mg/m³ (based on AF of 1) | irritation (respiratory tract) | The critical health effect is irritation in the upper respiratory tract. Derived from SCOEL STEL of 100 ppm/416 mg/m³ (2005). See discussion. |
| Long-term - systemic effects | Dermal | DNEL (Derived No Effect Level) | 13.67 mg/kg bw/day | NOAEL: 164.04 mg/kg bw/day (based on AF of 12) | repeated dose toxicity | Derived from NOAEL in 2 year study in drinking water.See discussion |
| Long-term - systemic effects | Inhalation | DNEL (Derived No Effect Level) | 208 mg/m³ | NOAEC: 208 mg/m³ (based on AF of 1) | repeated dose toxicity | Derived from SCOEL IOELV of 50 ppm/208 mg/m³ (2005). See discussion. |
| Long-term - local effects | Dermal | DNEL (Derived No Effect Level) | 1.5 mg/cm² | : 15.0 mg/cm² (based on AF of 10) | sensitisation (skin) | See discussion |
| Long-term - local effects | Inhalation | DNEL (Derived No Effect Level) | 208 mg/m³ | : 208 mg/m³ (based on AF of 1) | repeated dose toxicity | Derived from SCOELIOELV of 50 ppm/208mg/m³ (2005). See discussion. |
| **) The (corrected) dose descriptor starting points have been automatically calculated by multiplying the values of the fields "D(N)MEL" and"Assessment factor" provided in the Endpoint summary of IUCLID section 7. Toxicological information. It reflects the value after any corrections, e.g. route-to-route extrapolation. See column "Justification" and the discussion below for the rationale behind such modifications and the use of assessment factors.* | | | | | | |

DN(M)ELs for the general population

| **Exposure pattern** | **Route** | **Descriptor** | **DNEL / DMEL** | **(Corrected) Dose descriptor *)** | **Most sensitive endpoint** | **Justification** |
|---|---|---|---|---|---|---|
| Acute - systemic effects | Dermal | | | | | Single dermal doses of MMA caused no other effects than dermal irritation. An acute dermal DNEL for systemic effects is not necessary. |
| Acute - systemic effects | Inhalation | | | | | The critical health effect is irritation in the upper respiratory tract. The chronic DNEL will be protective against |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | this endpoint. |
| Acute - systemic effects | Oral | Exposure based waiving | | | | Low acute toxicity; Additionally, since the substance exhibits a low log Pow (1.38), is readily biodegradable and rapidly metabolised in rodents and humans, secondary poisoning is unlikely to be a relevant route of exposure. Calculated data based on the the regional assessment included in chapter 9.5 of the CSR confirm that secondary poisoning is of low concern. |
| Acute - local effects | Dermal | DNEL (Derived No Effect Level) | 1.5 mg/cm² | : 15.0 mg/cm² (based on AF of 10) | sensitisation (skin) | |
| Acute - local effects | Inhalation | DNEL (Derived No Effect Level) | 208 mg/m³ | : 416 mg/m³ (based on AF of 2) | irritation (respiratory tract) | The critical health effect is irritation in the upper respiratory tract. Derived from SCOEL STEL of 100 ppm/416 mg/m³ (2005). See discussion. |
| Long-term - systemic effects | Dermal | DNEL (Derived No Effect Level) | 8.2 mg/kg bw/day | NOAEL: 164.0 mg/kg bw/day (based on AF of 20) | repeated dose toxicity | Derived from NOAEL in 2 year study in drinking water. See discussion |
| Long-term - systemic effects | Inhalation | DNEL (Derived No Effect Level) | 74.3 mg/m³ | : 2,080.4 mg/m³ (based on AF of 28) | repeated dose toxicity | Derived from NOAEL in 2 year inhalation study. See discussion |
| Long-term - systemic effects | Oral | Exposure based waiving | | | | The substance is not added to food; Additionally, since the substance exhibits a low log Pow (1.38), is readily biodegradable and rapidly metabolised in rodents and humans, secondary poisoning is unlikely to be a relevant route of exposure. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Calculated data based on the the regional assessment included in chapter 9.5 of the CSR confirm that secondary poisoning is of low concern. |
| Long-term - local effects | Dermal | DNEL (Derived No Effect Level) | 1.5 mg/cm² | : 15.0 mg/cm² (based on AF of 10) | sensitisation (skin) | |
| Long-term - local effects | Inhalation | DNEL (Derived No Effect Level) | 105 mg/m³ | : 208 mg/m³ (based on AF of 2) | repeated dose toxicity | Derived from SCOEL IOLV of 50 ppm/208 mg/m³ (2005). See discussion. |

**) The (corrected) dose descriptor starting points have been automatically calculated by multiplying the values of the fields "D(N)MEL" and "Assessment factor" provided in the Endpoint summary of IUCLID section 7. Toxicological information. It reflects the value after any corrections, e.g. route-to-route extrapolation. See column "Justification" and the discussion for the rationale behind such modifications and the use of assessment factors.*

PNEC

| PNEC | Value | Assessment factor | Remarks/Justification |
|---|---|---|---|
| PNEC aqua - freshwater (mg/L) | 0.94 | 10 | The calculation of PNEC freshwater is based on the results for thetoxicity of methyl methacrylate to the most sensitive species Daniorerio in a long-term toxicity study (OECD 210; NOEC = 9.4 mg/L). The derivation of PNEC aqua freshwater can be based on three long-term NOECs from species representing three trophic levels. Therefore, according to the TGD, an assessment factor of 10 has been used for the calculation of PNEC. |
| PNEC aqua -marine water (mg /L) | 0.94 | 10 | The calculation of PNEC marine waters is based on the results for the toxicity of methyl methacrylate to the most sensitive freshwater species Danio rerio in a long-term toxicity study (OECD 210;NOEC = 9.4 mg/L). The derivation of PNEC marine waters can bebased on three long-term NOECs from species representing threetrophic levels. A publication with data on a series of 12 different marine organisms with the common metabolite of the category, methacrylic acid, indicate that marine species are not expected to be more sensitive to methacrylates than freshwater species (Sverdrup, 2001). Therefore the same AF is used for freshwater and marine organisms. |
| PNEC aqua - intermittent releases (mg /L) | 0.94 | 10 | The most sensitive species for acute toxicity testing was Daphnia magna (EC50 = 69 mg/L). Using the default assessment factor of 100, a PNEC of 0.69 mg/L would be derived for intermittent releases. This value is lower than the chronic PNEC and, hence, makes no sense. Instead, the chronic PNEC is used as the departure point for the assessment of intermittent releases. |
| PNEC fresh water sediment (mg/kg sediment dw ) | 5.74 | | extrapolation method<br><br>The calculation of PNEC sediment for methyl methacrylate is |

| | | | |
|---|---|---|---|
| | | | based on the data for PNEC aqua (0.94 mg/L) and log Koc (1.86).The calculation is based on an assumed average dry weight for sediment. |
| PNEC $_{marine-sediment}$(mg/kg sediment dw ) | | | Based on properties (low toxicity, low logP, ready biodegradability)sediment is not even a target compartment in freswater. For marine sediment, which is much more remote from emission sources, derivation of a PNEC is not relevant. |
| PNEC $_{soil}$(mg/kg soil dw ) | 1.47 | | The calculation of PNEC soil for methyl methacrylate is based on the data for PNEC aqua (0.94 mg/L), log Koc (1.86) and HLC (14.7 Pa*m³/mol). The calculation is based on an assumed average dry weight for soil. |
| PNEC stp(mg/L) | 10 | 10 | The calculation of the PNEC STP is based on the result of a biodegradation study. At 100 mg/L MMA was biodegraded by 94 %without apparent microbial toxicity. |
| PNEC oral(mg/kg food ) | | | Since the substance exhibits a low log Pow (1.38), is readily biodegradable and rapidly metabolised in rodents and humans, secondary poisoning is unlikely to be a relevant route of exposure.Calculated data based on the regional assessment included in chapter 9.5 confirm that secondary poisoning is of low concern.. |

### 8.2 Exposure controls

**8.2.1 Appropriate engineering controls:** Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**8.2.2 Individual protection measures, such as personal protective equipment: Eye/face protection:** Tightly fitting goggles.

**Hand protection:** Wear suitable gloves. In permeation tests PVA/Polyethylene laminate and supported PVA gloves perform best. Butyl and nitrile rubber gloves also offer some protection butshould be changed immediately if exposure occurs. Latex "surgical" gloves offer little protection.

**Body protection:** On handling of larger quantities: face mask, chemical-resistant boots and apron.

**Respiratory protection:** Breathing apparatus in case of high concentrations, short term: filter appliance, filter A.

In the event of formation of particularly high levels of vapour a self contained breathingapparatus may be appropriate. Gloves should be changed regularly and if excessive exposure has occurred. Example: butyl rubber gloves (0.7 mm), Break through time 60min (EN 374).

**Thermal hazards:** Wear suitable protective clothing to prevent heat.

**8.2.3 Environmental exposure controls:** Avoid discharge into the environment.
According to local regulations, Federal and official regulations.

## Section 9 Physical and chemical properties

### 9.1 Information on basic physical and chemical properties

**Appearance** Li quid

| | |
|---|---|
| **Melting point/range (°C):** | -48 °C |
| **Boiling point/range (°C):** | 100.36 °C at 1013.25 hPa |
| **Flash point (°C):** | 10 °C (cc) |
| **Self-ignition temperature:** | 400 °C |

| | |
|---|---|
| **Vapour pressure (25°C):** | 37 hPa at 20 °C |
| **Relative Density:** | 0.94 g/cm$^3$ at 20 °C |
| **Water solubility (g/l):** | 15.3 g/L at 20 °C |
| **n-Octanol/Water (log Po/w):** | LogPow = 1.38 |
| **Viscosity:** | 0.53 mPa s (dynamic) |
| **Surface tension:** | Not applicable |
| **Dissociation constant in water( pKa):** | Not applicable |

**9.2. Other information:**

| | |
|---|---|
| **Flammability:** | Highly flammable. |
| **Explosive properties :** | Non explosive |
| **Oxidising properties :** | No oxidising properties |
| **Granulometry :** | Not applicable |
| **Stability in organic solvents and identity of relevant degradation products :** | Not applicable |

## Section 10 Stability and reactivity

| | |
|---|---|
| **10.1 Reactivity:** | The substance is stable under normal storage and handling conditions. |
| **10.2 Chemical stability:** | Stable at room temperature in closed containers under normal storage and handling conditions. |
| **10.3 Possibility of hazardous reactions:** | Polymerization with heat evolution may occur in the presence of radical forming substances (e.g. peroxides), reducing substances, and/or heavy metal ions. |
| **10.4 Conditions to avoid:** | Incompatible materials. If the permissible storage period and/or storage temperature is exceeded, the product may polymerize with heat evolution. |
| **10.5 Incompatible materials:** | Reactions with strong oxidizing agents. |
| **10.6 Hazardous decomposition products:** | Carbon oxides. |

## Section 11 Toxicological information

**11.1 Toxicokinetics, metabolism and distribution**

There are extensive data available for MMA and this has been reviewed in the EU Risk Assessment (2002). Sufficient data is available to confirm applicability of this data across all members of the category and this has been reviewed in the OECD SIAR (2009). Data on MAA, the common metabolite, has been reviewed in the EU Risk Assessment (2002). The following text relies on these reviews.

**Basic absorption, distribution,metabolism and excretion (ADME), toxicokinetics**

Data availability:

There are extensive data available for the methyl ester (MMA) and this has been reviewed in the EU Risk Assessment (2002). Sufficient datais available to confirm applicability of this data across all members of the category and this has been reviewed in the OECD SIAR (2009). Data on MAA, the common metabolite, has been reviewed in the EU Risk Assessment (2002). The following text relies on these reviews withany addition to the original documents is italicised.

Trends/Results

Taken from the EU Risk Assessment on MMA; “after oral or inhalation administration, methyl methacrylate is rapidly absorbed and distributed.In vitro skin absorption studies in human skin indicate that methyl methacrylate can be absorbed through human skin, absorption being enhanced under occluded conditions. However, only a very small amount of the applied dose (0.56%) penetrated the skin under unoccluded conditions (presumably due to evaporation of the ester from the skin surface (Syngenta/CEFIC, 1993)). After inhalation exposure to rats 10 to

20% of the substance is deposited in the upper respiratory tract where it is metabolized (by non-specific esterases to the acid, MAA (Morris,

1992)). Activities of local tissue esterases of the nasal epithelial cells appear to be lower in man than in rodents (Green, 1996 later published as Mainwaring, 2001). Toxicokinetics seem to be similar in man and experimental animal. After arthroplasty using methyl methacrylate-based cements, exhalation of unchanged ester occurs to a greater extent than after i. v., i. p. or oral administration. After oral or parenteral administration methyl methacrylate is further metabolised by physiological pathways with the majority of the administered dose being exhaled as CO2(Bratt and Hathway, 1977; ICI, 1977a). Conjugation with GSH or NPSH plays a minor role in methyl methacrylate metabolism and only occurs at high tissue concentrations (McCarthy and Witz, 1991; Elovaara et al., 1983) ".

Taken from the OECD SIAR: "Other short chain alkyl-methacrylate esters, like MMA, are initially hydrolysed by non-specific carboxylesterases to methacrylic acid and the structurally corresponding alcohol in several tissues (ECETOC 1995, 1996b).

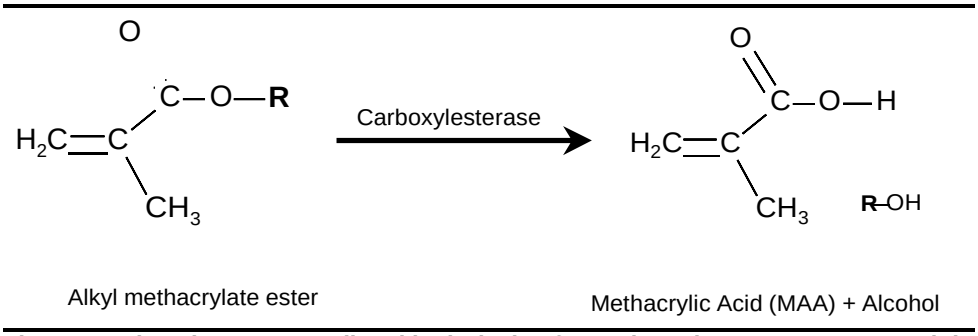


**Figure : Carboxylesterase mediated hydrolysis of a methacrylate ester to MAA and the structurally corresponding alcohol**

Methacrylic acid and the corresponding alcohol are subsequently cleared predominantly via the liver (valine pathway and the TCA (TriCarboxylic Acid) cycle, respectively). The carboxylesterases are a group of non-specific enzymes that are widely distributed throughout the body and are known to show high activity within many tissues and organs, including the liver, blood, GI tract, nasal epithelium and skin (Satoh & Hosokawa, 1998; Junge & Krish, 1975; Bogdanffy et al., 1987; Frederick et al., 1994). Those organs and tissues that play an important role and/or contribute substantially to the primary metabolism of the short-chain, volatile, alkyl-methacrylate esters are the tissues at the primary point of exposure, namely the nasal epithelia and the skin, and systemically, the liver and blood.

Methacrylate esters can conjugate with glutathione (GSH) in vitro, although they show a low reactivity, since the addition of a nucleophile at the double bond is hindered by the alpha-methyl side-group (McCarthy & Witz, 1991, McCarthy et al., 1994, Tanii and Hashimoto, 1982). Hence, ester hydrolysis is considered to be the major metabolic pathway for alkyl-methacrylate esters, with GSH conjugation only playing a minor role in their metabolism, and then possibly only when very high tissue concentrations are achieved.

Studies completed after the MMA RA have confirmed that all short chain alkyl-methacrylate esters are rapidly hydrolysed by ubiquitous carboxylesterases (see table below, adapted from Jones; 2002). First pass (local) hydrolysis of the parent ester has been shown to be significant for all routes of exposure. For example, no parent ester can be measured systemically following skin exposure to EMA and larger esters, as the lower rate of absorption for these esters is within the metabolic capacity of the skin (Jones, 2002). Parent ester will also be effectively hydrolysed within the G. I. tract and within the tissues of the upper respiratory tract (particularly the olfactory tissue). Systemically absorbed parent ester will be effectively removed during the first pass through the liver (%LBF; see table below) resulting in their relatively rapid elimination from the body (T50%; see table below).

**Rate Constants for ester hydrolysis by rat-liver microsomes and predicted systemic fate kinetics following i.v. administration.**

| Ester | Rat liver microsomes (100 μg ml$^{-1}$) $V_{max}$ (nM min$^{-1}$ mg$^{-1}$) | $K_m$ (μM) | CL (%LBF) | $T_{50\%}$ (min) | $C_{max}$ (MAA) (mg L$^{-1}$) | $T_{max}$ (MAA) (min) |
|---|---|---|---|---|---|---|
| MAA | - | - | 51.6% | - | - | - |
| MMA | 445.8 | 164.3 | 98.8% | 4.4 | 14.7 | 1.7 |
| EMA | 699.2 | 106.2 | 99.5% | 4.5 | 12.0 | 1.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| i-BMA | 832.9 | 127.4 | 99.5% | 11.6 | 7.4 | 1.6 |
| n-BMA | 875.7 | 77.3 | 99.7% | 7.8 | 7.9 | 1.8 |
| HMA | 376.4 | 34.4 | 99.7% | 18.5 | 5.9 | 1.2 |
| 2EHMA | 393.0 | 17.7 | 99.9% | 23.8 | 5.0 | 1.2 |
| OMA | 224.8 | 11.0 | 99.9% | 27.2 | 5.0 | 1.2 |

*HMA – hexyl methacrylate; OMA – octyl methacrylate. Fate kinetics determined using the "well-stirred" model; CL%LBF – Clearance as percentage removed from liver blood flow i.e. first pass clearance; $T_{50\%}$ - time taken for 50% of parent ester to have been eliminated from the body; $C_{max}$ – maximum concentration of MAA in circulating blood; $T_{max}$ – time in minutes to peak MAA concentration in blood "Jones, 2002".*

**Summary of the results for the peak rates of absorption of MAA & alkylmethacrylate esters through rat & human epidermis**

| | Rat epidermis | | | Human epidermis | | |
|---|---|---|---|---|---|---|
| **Ester** | **Peak rate of absorption (µg cm-2hr-1) ±SEM** | **Period of peak absorption rate (hours)** | **% age of applied dose absorbed over x hours** | **Peak rate of absorption (µg cm-2hr 1) ±SEM** | **Period of peak absorption rate (hours)** | **% age of applied dose absorbed over x hours** |
| MAA | 23825±2839 | 0.5-4 | 93% / 24h | *812* | - | - |
| MMA | 5888±223 | 2-8 | 46% / 16h | 453±44.5 | 4-24 | 10% / 24h |
| EMA | *4421* | - | - | *253* | - | - |
| i-BMA | *1418* | - | - | *80* | - | - |
| n-BMA | 1540±69 | 0-6 | 18% / 24h | 76.7±9.8 | 0-24 | 2% / 24h |
| HMA | *147* | - | - | *25* | - | - |
| 2EHMA | 234±4.8 | 0-30 | 7.8% / 30h | 22.7.7±3.7 | 3-24 | 0.6% / 24h |
| OMA | 159±15 | 0-24 | - | *7.8* | - | - |

Key: The values in normal type were obtained experimentally, whilst those in italics, are predicted values based on statistical analysis (single exponential fit) of the experimental data

In terms of MAA, the common metabolite for these esters, the following can be taken from the EU ESR: "Methacrylic acid is rapidly absorbed in rats after oral and inhalative administration. A high dose orally administered methyl methacrylate is rapidly hydrolyzed by esterases and the methacrylic acid concentration in the blood serum reached a very low level after one hour. In an inhalation study deposition efficiency of 95%was measured in the surgically isolated upper respiratory tract of anaesthetized rats (Morris and Frederick, 1995). However, the degree of penetration to underlying cells could not be derived from this experiment. There are no studies which specifically address th e metabolism of exogenously applied methacrylic acid. "

Studies completed after the EU ESR on MAA indicate rapid absorption through skin and subsequent clearance from blood. Topically applied MAA absorbs rapidly through intact rat epidermis and viable whole skin in-vitro (Jones, 2002). In another study intravenous injection of MAA in rats demonstrated very rapid clearance from the blood (half-life <5mins), suggestive of rapid subsequent metabolism (Jones, 2002).

Trends

Short chain esters and MAA are absorbed by all routes. The rate of absorption decreases with increasing ester chain length. All esters are rapidly hydrolysed in local tissues as well as in blood by non-specific esterases. There is a trend towards increasing half-life of the ester in blood with increasing ester chain length (table 11). The primary metabolite, MAA, is cleared rapidly from blood in all cases.

Conclusions

MMA and the other methacrylate esters are readily absorbed by all routes and rapidly hydrolyzed by carboxylesterases to metha crylic acid (MAA) and the respective alcohol. Clearance of the parent ester from the body is in the order of minutes. The primary metabolite, MAA, is subsequently cleared rapidly from blood and, as indicated by studies with MMA, this metabolism is by standard physiological pathways, with the majority of the administered dose being exhaled as CO2.

Local effects resulting from the hydrolysis of the ester to MAA are only observed following inhalation exposure and this has been shown to be due to the localised concentration of non-specific esterases in nasal olfactory tissues. In summarising the available PBPK data on MMA SCOEL concluded that "ExtensivePBPK modelling work has predicted that on kinetic grounds for a given level of exposure to MMA human nasal olfactory epithelium will be at least 3 times less sensitive than that of rats to the toxicity of MMA" (SCOEL, 2005).

**11.2 Information on toxicological effects**

**Acute toxicity:**

**LD50(Oral, Rat):** 7900 mg/kg bw

**LD50(Dermal, Rabbit):** 5000 mg/kg bw

**LC50(Inhalation, Rat):** 29800 mg/m³ air

**Skin corrosion/Irritation:** Causes skin irritation.

**Serious eye damage/irritation:** Not classified

**Respiratory or skin sensitization:** May cause an allergic skin reaction.

**Germ cell mutagenicity:** Not classified

**Carcinogenicity:** Not classified

**Reproductive toxicity:** Not classified

**STOT- single exposure:** May cause respiratory irritation.

**STOT-repeated exposure:** Not classified

**Aspiration hazard:** Not classified

## Section 12 Ecological information

**12.1 Toxicity:**

| Acute toxicity | | Time | Species | Method | Remarks |
|---|---|---|---|---|---|
| LC50 | > 79 mg/L | 96h | Fish | equivalent or similar to EPA OTS 797.1400 (Fish Acute Toxicity Test) | 1 (reliable without restriction) key study experimental result |
| EC50 | 69 mg/L | 48h | Daphnia | equivalent or similar to EPA OTS 797.1300 (Aquatic Invertebrate Acute Toxicity Test, Freshwater Daphnids) | 1 (reliable without restriction) key study experimental result |
| EC50 | > 110 mg/L | 72h | Algae | OECD Guideline 201 (Alga, Growth Inhibition Test) | 1 (reliable without restriction) key study experimental result |

**12.2 Persistence and degradability:** readily biodegradable

**12.3 Bioaccumulative potential:** Based on a log Pow of 1.38, bioaccumulation of methyl methacrylate is not expected.

**12.4 Mobility in soil:** Not available

**12.5 Results of PBT&vPvB assessment:** The substance is not considered a PBT/vPvB.

**12.6 Other adverse effects:** Not available.

## Section 13 Disposal considerations

**13.1 Waste treatment methods** Due to the high risk of contamination recycling/recovery is not recommended. Waste disposal in accordance with regulations (most probably controlled incineration).

## Section 14 Transport information

| | Land transport(ADR/RID) | Sea transport (IMDG) | Air transport (ICAO/IATA) |
|---|---|---|---|
| **UN-Number:** | 1247 | 1247 | 1247 |
| **UN Proper shipping name:** | METHYL METHACRYLATE MONOMER, STABILIZED | METHYL METHACRYLATE MONOMER, STABILIZED | METHYL METHACRYLATE MONOMER, STABILIZED |
| **Transport hazard Class:** | 3 | 3 | 3 |
| **Packaging group:** | II | II | II |
| **Environmental hazards:** | No | No | No |
| **Special precautions for user:** | See section 2.2 | See section 2.2 | See section 2.2 |
| **Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code** | IBC02 | IBC02 | IBC02 |

## Section 15 Regulation information

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

**Relevant information regarding authorization:** Not applicable.

**Relevant information regarding restriction:** Not applicable.

**Other EU regulations:** Employment restrictions concerning young person must be observed. For use only by technically qualified individuals.

**Other National regulations:** Not applicable

**15.2 Chemical Safety Assessment has been carried out?** YES [X] NO [ ]

## Section 16 Other information

**16.1 Indication of changes**

Version 1.0 Amended by (EU) 2015/830

Version 2.0 Exposure scenarios are placed after section 16.

**16.2 Training instructions:**

Not applicable.

**16.3 Further information:**

This information is based upon the present state of our knowledge. This SDS has been compiled and is solely intended for this product.

**16.4 Notice to reader:**

Employers should use this information only as a supplement to other information gathered by them, and should make independent

judgment of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Safety Data Sheet, or in combination with any otherproduct or process, is the responsibility of the user.