METHACRYLATE PRODUCERS ASSOCIATION, INC.

GLOBAL PRODUCT SUMMARY:
BASIC METHACRYLATE CATEGORY

(Last Updated: 9/30/19)
Disclaimer

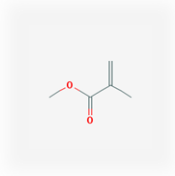
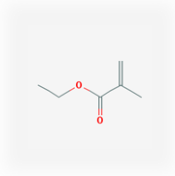
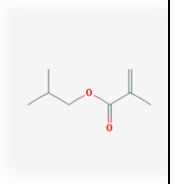
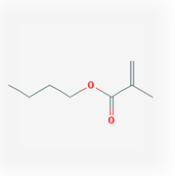
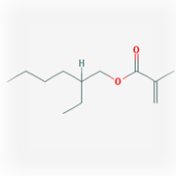
SUBSTANCE NAME

Basic Methacrylate Category

GENERAL STATEMENT

Methacrylate monomers are produced for use as building blocks to make a wide range of polymer-based products that we see and use every day from acrylic glass, car paints, toners and inks, oil additives to dental and medical products to name but a few. They are of low concern to human health and the environment. They are classified as hazardous (skin irritant and sensitizing and, in some cases, flammable or highly flammable). However, methacrylate monomers have been handled safely by industry and professionals for over 60 years. These methacrylate-based polymers are inert in the environment and can be recycled, but more typically, are used for energy recovery.

CHEMICAL IDENTITY

Substance	Methyl Methacrylate	Ethyl Methacrylate	i-Butyl Methacrylate	n-Butyl Methacrylate	2-Ethylhexyl Methacrylate
					
EC number:	201-297-1	202-597-5	202-613-0	202-615-1	211-708-6
EC name:	Methyl methacrylate	ethyl methacrylate	isobutyl methacrylate	butyl methacrylate	2-ethylhexyl methacrylate
CAS number:	80-62-6	97-63-2	97-86-9	97-88-1	688-84-6
IUPAC name:	2-Methyl-propenoic acid, methyl ester	ethyl methacrylate	isobutyl methacrylate	butyl methacrylate	2-ethylhexyl methacrylate
Molecular formula:	$C_5H_8O_2$	$C_6H_{10}O_2$	$C_8H_{14}O_2$	$C_8H_{14}O_2$	$C_{12}H_{22}O_2$

USES AND APPLICATIONS

Methacrylates are produced for use by industry as monomer for production of polymers. The substances are manufactured in industrial settings in closed systems and used by industry for manufacture of polymers in closed and semi-closed systems. Downstream use of methacrylates is almost exclusively in the form of polymer although some products used by professionals and DIY/hobbyists may contain quantities of the liquid monomer.

PHYSICAL/CHEMICAL PROPERTIES

The following table includes information, which refers to testing performed with the concentrated (liquid) monomer substance. It is not intended to be comprehensive or to replace information found in the Safety Data Sheet (SDS). A SDS may be obtained from one of the manufacturers.

Substance	Methyl methacrylate	Ethyl methacrylate	i-Butyl Methacrylate	n-Butyl Methacrylate	2-Ethylhexyl Methacrylate
Physical state	Liquid	Liquid	Liquid	Liquid	Liquid
Color	Colorless	Colorless	Colorless	Colorless	Colorless
Odor	Pungent	Pungent	Pungent	Pungent	Pungent
Density (at 20 °C)	0.94 g/cm3	0.91 g/cm^3	0.88 g/cm^3 (25°C)	0.89 g/cm^3	0.88 g/cm^3
Melting Point (at 1013.25 hPa)	-48 °C	<-75 °C	-35 °C	-50 °C	<-50 °C
Boiling point (at 1013.25 hPa)	100.36 °C	118 - 119 °C	155 °C (at 1025 hPa)	163 °C	227.6 °C
Flammability	Highly flammable	Highly flammable	Flammable	Flammable	Not flammable
Explosive properties	Not explosive	Not explosive	Not explosive	Not explosive	Not explosive
Self-ignition temperature	400 °C	400 °C	385 °C	294 °C	250 °C
Vapor Pressure (at 20 °C)	37 hPa	20 hPa	2.11 hPa	2.12 hPa	0.065 hPa
Molecular Weight	100.1	114.1	142.2	142.2	198.3
Water solubility (at 20 °C)	15300 mg/L	469 mg/L	470 mg/L	360 mg/L (25 °C)	3.1 mg/L
Flash point (at 1013.25 hPa)	10 °C Closed cup	18 °C	42.5 °C	48.5 °C	97 °C
Octanol-water partition coefficient (LogKow at 20 °C)	1.38	1.87	2.95	3 (25 °C)	4.95

HUMAN HEALTH SAFETY ASSESSMENT

Information for the general population and consumers handling products made with the category substances.

Consumer

The majority of monomers produced is converted to polymers before being used in consumer products. Since these polymers typically contain extremely low levels of residual monomer, exposure to liquid monomer is unlikely. Some professional, DIY and hobbyist products may contain liquid monomers (MMA/EMA and BMA). Direct skin contact with liquid monomer could produce skin irritation, and repeated contact could lead to skin sensitization (allergy or dermatitis). Inhalation of high levels of vapors may irritate the respiratory system.

Worker

methacrylate monomers are produced in essentially closed systems so that significant worker exposure during monomer manufacture is unlikely. Workers may come into contact with monomers during polymer production and professional use of products containing liquid monomer. The health effects following skin contact or inhalation of the vapors would be the same as for the consumer.

The following table includes information for someone handling the concentrated substances. The data, while verifiable, are not intended to be comprehensive nor replace the information found in the SDS.

Effect Assessment	Result
Acute Toxicity	Low toxicity after oral, dermal and inhalation exposure.
Irritation	Causes irritation to the skin and volatile monomers can cause irritation of the respiratory system. Not irritating to the eyes.
Sensitization	Sensitizing by skin contact. Click here for a technical summary. By weight of evidence, does not cause asthma.
Mutagenicity	Not mutagenic. Click here for a technical summary. No evidence of carcinogenicity. Click here for a technical summary.
Toxicity after repeated exposure	Inhalation of volatile monomers can cause damage to the part of the nose responsible for detection of smell when consistently inhaled over a longer period of time. Other effects in the body are non-specific.
Toxicity for reproduction	Does not harm reproduction or cause birth defects at levels that are not toxic to the mothers. Click here for a technical summary.

ENVIRONMENTAL SAFETY ASSESSMENT

Based on available, data methacrylate monomers are of low to moderate toxicity to aquatic organisms and are not classified as hazardous for the environment. These methacrylate monomers are fully and rapidly biodegradable. While they are not intentionally released during manufacturing processes and use, monomer released to air or trace amounts present in waste water streams would rapidly disappear by chemical and biological degradation. These methacrylate monomers do not possess significant ozone depletion potential.

The following tables include information for testing performed with the concentrated (liquid) monomer substance. Additional information may be obtained from the SDS supplied by the manufacturer.

Effect Assessment	Result
Aquatic Toxicity	Toxicity to aquatic organisms ranges across the category from Low (EMA), Moderate (MMA), toxic (nBMA), harmful (iBMA) to toxic with long-lasting harmful effects (EHMA).

Fate and behaviour	Result
Biodegradation	Readily biodegradable
Bioaccumulation potential	Low (EMA, EHMA) to no potential to bioaccumulate (MMA, iBMA, nBMA).
PBT / vPvB conclusion *	Does not meet the criteria for PBT or vPvB classification
Environmental impact	Unlikely to persist in, or have significant impact on, the environment. Click here for a technical summary.

* Persistent/Bioaccumulative/Toxic (PBT) very Persistent-very Bioaccumulative (vPvB)

EXPOSURE

Consumer

Consumer exposure to methacrylate monomers is generally limited to products containing polymers made from them. These polymers contain extremely low levels of residual monomer. Exposure of consumers to liquid monomer is therefore unlikely, unless they use professional, DIY or hobbyist products that contain significant levels of liquid monomer. In that case, exposure can occur if consumers have direct skin and/or nail contact with the liquid monomer. In addition, inhalation of vapors may be unintentional or unavoidable when using such products. Direct skin and/or nail contact in cosmetic (artificial nails) uses may be unavoidable and such use is not recommended.

Worker

Methacrylate monomers are produced in essentially closed systems; therefore, significant worker exposure during manufacture is unlikely. Workers may come into contact with monomers during polymer production and professional use of products containing liquid monomer.

RISK MANAGEMENT RECOMMENDATIONS

Consumer

For consumer use of products containing methacrylate-based polymers, risk management measures relating to the very low residues in those polymers are not indicated. Use of professional, DIY and hobbyist products that contain liquid methacrylate monomer will require the user to follow the guidance provided by the product manufacturer on the packaging or product label. This will depend upon the product composition, but may include recommendations to avoid skin contact (to prevent skin irritating / sensitizing properties) and to provide good general ventilation (to prevent irritation of the respiratory system by high concentrations of the vapors) when handling the uncured (liquid, unpolymerized) product. Uncured (liquid, unpolymerized) product should not be poured down the drains or disposed of in domestic waste. Read the instructions on safe disposal on the packaging or contact the supplier for advice. Any applications involving direct skin and/or nail contact with liquid monomer that are not under the direct supervision of a medical or dental professional are not recommended (for further reference, see MPA's policy regarding the use of methacrylates in artificial nails).

Worker

As for any substance, workers should follow the recommended safety measures as provided by the manufacturer in the Safety Data Sheet. Considering the skin irritating and sensitizing properties of methacrylate monomers, this typically will include avoiding skin contact or the wearing of suitable protective gloves and avoiding inhalation of high concentrations of vapor by use of one or more of the following: engineering controls, good general ventilation or personal protective (respiratory) equipment, depending upon the particular use conditions.

REGULATORY INFORMATION / CLASSIFICATION AND LABELLING

All of these substances are subject to a number of federal and international statutes and regulations. Selected U.S. regulatory information is available on the MPA website. Other federal, state and local regulations may apply.

All of these substances have been registered under the EU chemical control law known as REACH (Registration, Evaluation, Authorisation and Restriction of Chemical substances), and arelisted on various chemical inventories. They have been reviewed under the OECD SIDS (Screening Information Data Set) program.

While the toxicological data are not specific to a particular region, the regulatory frameworks differ between countries and regions. The Global Harmonized System (GHS) attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use. Under the GHS, substances are classified according to their physical, health, and environmental hazards.

Note: The hazard statements and symbols presented here refer to the hazard properties of the concentrated substances and are meant to provide a brief overview of the labelling for the substance. It is not intended to be comprehensive or to replace information found in the SDS.

Classification and Labelling:

Substance	Methyl Methacrylate	Ethyl Methacrylate	i-Butyl Methacrylate	n-Butyl Methacrylate	2-Ethylhexyl Methacrylate
Classifications					
Flammable liquid	Category 2	Category 2	Category 3	Category 3	
Acute Toxicity	Category 5 (inhalation)				
STOT single exposure	Category 3	Category 3	Category 3 (respiratory)	Category 3 (respiratory)	Category 3 (respiratory)
Skin corrosion/irritation	Category 2	Category 2	Category 2	Category 2	Category 2
Skin sensitization	Category 1	Category 1B	Category 1B	Category 1B	Category 1B
Aquatic Acute	Category 3		Category 3*	Category 2*	Category 2
Aquatic Chronic					Category 3
Eye Irritation					Category 2
Labelling					
Signal word:	Danger	Danger	Danger	Danger	Warning
Hazard pictogram: GHS02:					
GHS07: exclamation mark					
Hazard Statements					
H225: Highly flammable liquid and vapor	Yes	Yes			
H226: Flammable liquid and vapor			Yes	Yes	
H315: Causes skin irritation	Yes	Yes	Yes	Yes	
H316: Causes mild skin irritation					Yes
H317: May cause an allergic skin reaction	Yes	Yes	Yes	Yes	Yes
H319: Causes serious eye irritation		Yes			
H335: May cause respiratory irritation	Yes	Yes	Yes	Yes	
H401: Toxic to aquatic life				Yes*	Yes
H402: Harmful to aquatic life	Yes*		Yes*		
H412: Harmful to aquatic life with long lasting effects					Yes

*Not used in some countries including the U.S.A. and EU

ADDITIONAL INFORMATION

Information on registered substance (ECHA):

- MMA: https://echa.europa.eu/registration-dossier/-/registered-dossier/15528
- MAA: https://echa.europa.eu/registration-dossier/-/registered-dossier/15411/2/1
- EMA: https://echa.europa.eu/registration-dossier/-/registered-dossier/13871
- n-BMA: https://echa.europa.eu/registration-dossier/-/registered-dossier/15151
- i-BMA: https://echa.europa.eu/registration-dossier/-/registered-dossier/14969
- EHMA: https://echa.europa.eu/registration-dossier/-/registered-dossier/13871/1

EU Risk Assessment:

- MMA: https://echa.europa.eu/documents/10162/7c9a0eb6-9b7f-4fd6-846b-d480e8e0003d
- MAA: https://echa.europa.eu/documents/10162/f0b94b4b-a87b-442b-b647-8ff56895c92c

OECD SIDS

- MMA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=56b5aa4e-044a-4a1d-8aca-9dcf9e1a0a8c
- MAA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=5495e306-d9ff-4847-9847-35f746088671
- EMA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=319e0a7e-feac-4468-824d-f9661b37a8ac
- n-BMA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=98b6bb52-f74f-46d6-a226-6306bc51d20b
- i-BMA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=197cccaa-569c-4a3d-b49f-2c0b1135fd37
- EHMA: https://hpvchemicals.oecd.org/ui/SIDS_Details.aspx?id=60633b61-f4f0-4131-a064-eb5d393714c8

CONTACT

For further information on this substance or product safety summaries in general, please contact MPA. Click on the logos below to go to the company's website.

Glossary

Acute toxicity - harmful effects after a single exposure
Bioaccumulation - accumulation of substance in an organism
Biodegradation- chemical breakdown of substances by a physiological environment
Carcinogenicity - effects causing cancer
Concentrated - Non-formulated undiluted substance
ECHA – European Chemicals Agency
EU - European Union
GHS - Global Harmonized System
Hazard - situation bearing a threat to health and environment
HPV - High Production Volume
IUPAC – International Union of Pure & Applied Chemistry
LogKow - Log Octanol-Water Partitioning Coefficient
Mutagenicity - effects that change genes
PBT/ vPvB - Persistent, Bioaccumulative and Toxic/Very Persistent and Very Bioaccumulative
OECD-Organisation for Economic co-operation and Development
REACH - Registration, Evaluation, Authorisation and Restriction of Chemical substances
SDS - Safety Data Sheet
Sensitizing - causes allergies
SIDS - Screening Inventory Data set
STOT – Specific Target Organ Toxicity

Disclaimer

This document is not intended to be comprehensive. It is provided solely as background information and should not substitute for an up-to-date Safety Data Sheet or research should specific regulatory or other legal questions arise. It is not intended to be a statement of legal requirements when using or handling acrylates. Although the information is believed to be accurate as of the last update, new information may become available and regulations frequently change, and no warranty, expressed or implied, is made concerning the contents. In addition, many states and localities adopt their own regulations, which are not covered by this summary or on the MPA website. In all events, the user should consult applicable laws and regulations, as well as their supplier's Safety Data Sheet, for current information and requirements. **NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN.**