Safety Data Sheet

1. Identification

Product name: methyl methacrylate (MMA)
Other names: -
Recommended use and restricted use: monomer of polymer
Name of manufacturer, importer or supplier: MMA PLANT, CHEMICALS DIVISION FORMOSA PLASTICS CORPORATION Address: No.1. FORMOSA INDUSTRIAL COMPLEX, MAILIAO VILLAGE, YUNLIN COUNTY, TAIWAN Telephone number: +886 5 6811437
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2. Hazards identification

Classification of the substance: Flammable liquid, Category 2, Skin corrosion, Category 2, Skin sensitization, Category 1, Acute aquatic toxicity, Category 3
Pictogram:  Symbol: Exclamation mark / Flame Signal word: Danger Hazard warning message: Highly flammable liquid and vapor Causes slightly skin irritation Causes eye irritation May cause allergic skin reaction Long-term exposure causes damage to liver, kidney and skin Aquatic organisms are harmful Hazard prevention measures: Avoid contact with skin If swallowed, consult a doctor immediately and show this container or label Keep away from heat/sparks/open flames/hot surfaces. -No smoking Wear protective gloves/protective clothing/protective glasses/protective masks If skin is contaminated: wash with plenty of soap and water If it gets into eyes: Rinse cautiously with water for several minutes. If you wear contact lenses and can easily remove them, remove the contact lenses Continuous rinse Seek medical attention immediately if you feel unwell Take off contaminated clothing and wash it before reuse Place the container in a well-ventilated place and cover the container tightly
Other hazards: -

3. Composition/Information on Ingredients

English names: methyl methacrylate (MMA)
Common name: Methacrylic acid methyl ester, Methyl alpha-methyl acrylate, Methyl 2-methyl 2-propenoate, Methyl 2-methyl propenoate, 2-Methyl propanoic acid methyl ester, MME
Chemical Abstract Service Registration Number (CAS No.) :80-62-6
Chemical identity: 99.9-100

4. First-aid measures

First aid methods for different exposure routes: If inhaled: (1) Determine your own safety before rescue someone (2) Remove the source of pollution or move the patient to fresh air (3) If breathing stops, give artificial respiration by trained personnel (4) Under the direction of a physician, oxygen is given by trained personnel (5) Get medical attention immediately In case of skin contact:(1) Avoid direct contact with chemicals, and wear gloves if necessary (2)

Immediately flush the contaminated area with running warm water for more than 20 minutes (3) Take off contaminated clothing, shoes and leather products (4) Confirm that contaminated clothing, shoes and leather products must be completely decontaminated before reuse or discard In case of eye contact: (1) Open your eyelids immediately and gently rinse with running warm water for more than 20 minutes (2) Be careful not to let the washed water spread to the uncontaminated eyes (3) Get medical attention immediately If swallowed: (1) If the patient is about to lose consciousness, or has lost consciousness or spasms, do not give anything by mouth (2) let the patient gargle thoroughly (3) Do not induce vomiting (4) Give the patient 240 ~ 300 ml of water (5) If the patient vomits spontaneously, lean forward to reduce the hazard of inhaled vomit (6) Get medical attention immediately First aid protection measures: It is not recommended to take actions that have not been professionally trained, or it may pose personal risks. If smoke remains on site, search and rescue personnel should wear appropriate masks or self-contained breathing apparatus. Mouth-to-mouth resuscitation can be dangerous.
The most important symptoms and harmful effects - Acute health effects: patient might lose consciousness and even die from pulmonary edema due to exposure to high concentrations.
Protection of emergency personnel: Wear Class C protective equipment and implement first aid in a safe area
Tips for physicians: Symptomatic treatment. When the patient swallows, consider gastric lavage and give medical grade activated carbon

5.Firefighting measures

Suitable extinguishing media: dry chemical powder, foam, carbon dioxide (CO_2)
Specific hazards when fire fighting: Both liquid-phase and vapor-phase are flammable. When heated, high pressure in the container may burst and cause explosion. The special gravity of vapors is greater than air, vapors may travel to source of ignition and flash back.
Special firefighting procedures: (1) If leakage occurs, spray the water mist can disperse the vapors formed by the escaped chemicals, thus prevent the persons from danger. (2) Once in a fire, block the exhaust to avoid vapors accumulating (3) When the safety vent valve of the tank sound or change color due to the fire, evacuate personnel to safe areas immediately. (4) Move containers away from the site without endangering people (5) Spray the water on the container which is exposed to the flame to cool it down
Special protective equipment and precaution for firefighters: Firefighters must wear air respirators, protective gloves, and firefighting clothing.

6.Accidental release measures

Personal precautions: (1) Remove sources of ignition (2) Avoid inhaling vapors and restrict access until the affected area is completely clean (3) Before cleaning up, review the training content of firefighting measures and operations (4) Always wear appropriate protective equipment (including respirator) when cleaning up
Environmental precautions: (1) Evacuate personnel to a well-ventilated area and use self-contained breathing protective equipment (2) Remove heat source, sparks, flames and power supply (3) Avoid contact with incompatible substances such as nitrates, oxidants/peroxides, polymerization initiators, strong bases, strong acids, etc.
Methods and materials for containment and cleaning up: (1) Use non-sparking tools, avoid substance contact, and do not let chemicals enter drains or confined spaces (2) Prevent further leakage or spill if safe to do so (3) Soak up with inert absorbent material, and remember that contaminated absorbents are as hazardous as leaked substance (4) If the leakage is small, after absorption by inert material, keep the material in a suitable, closed and clearly-marked

container. Rinse the contaminated area with water. (5) If the leakage is large, contact the fire and emergency treatment center or supplier for assistance.

7.Handling and storage

Precautions for safe handling:
(1) Avoid contact with skin and eyes. Avoid inhalation of high-concentration vapors. Work in well-ventilated place. (2) The storage barrels should be grounded, and the grounding clip need to be connected to bare metal. (3) Post no smoking signs in the working area. Use only non-sparking tools. Keep away from open flames, hot surfaces and sources of ignition. (4) Vapors are heavier than air and can accumulate in ditch and low areas. Beware of vapors accumulating to form explosive concentrations. Besides, take precautionary measures against static discharge during transportation. (5) Do not keep MMA under inert gas. The storage temperature of tank should be controlled below 25°C and the condition need to be free of moisture. (6) If inhibitor content is less than 25ppm, MMA can be stored for 6 months. However, it is recommended to use it within three months. If inhibitor content is 2ppm, it is recommended to use it within one month.

Conditions for safe storage:
(1) Keep in a cool, dry and well-ventilated place. Avoid direct sunlight. Stay away from heat, ignition sources and incompatible materials. Avoid becoming a source of ignition by well-grounded. The storage place should be labeled. Smoking is strictly prohibited. (2) Considering that there are no inhibitors in the MMA Vapors, the vent and flame arrester of the tank may be blocked by MMA polymer. (3) It is suggested that the storage temperature in the original containers such as iso tank or drum should not exceed 30°C.

8.Exposure controls/personal protection

Occupational safety exposure limits:

Control parameters

Components	Country	8 hours average TWA		Short time (15 minutes)		Notes
		ppm	mg/m^3	ppm	mg/m^3	
Methyl methacrylate	Taiwan	50	208	100	416	

Derived No-Effect Level (DNEL):

route of exposure	effect	labor	ordinary people
inhalation	long-term, systematic	210 mg/m^3	74.3 mg/m^3
inhalation	long-term, local	210 mg/m^3	105 mg/m^3
skin contact	long-term, systematic	13.67 mg/kg bw/d	8.2 mg/kg bw/d
skin contact	long-term, local	1.5 mg/cm^2	1.5 mg/cm^2
skin contact	acute, local	1.5 mg/cm^2	1.5 mg/cm^2

Predicted No-Effect Concentration (PNEC):

region	Limit
fresh water	0.94 mg/L
seawater	0.094 mg/L
periodic emissions (fresh water)	-
sediment in fresh water	5.74 mg/kg sediment dw
sediment in seawater	-
sewage treatment plant	10 mg/L
soil	1.47 mg/kg soil dw
air	No hazards found

Exposure control:
Engineering control: work in well-ventilated place. Use explosion-proof equipment.
Hygienic measures: wash hands thoroughly before eating, smoking, and using toilet after operation.
Eye/face protection: wear goggles. Make sure there is an eyewash on site.
Hand protection: wear chemical resistant gloves.

Body protection: wear complete suit protecting against chemicals. Other skin protection: protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace, such as protective shoes. Respiratory protection: use suitable, air-purifying respirators. Environmental exposure control: discharge of waste shall comply with current environmental protection regulations.

9.Physical and chemical properties

Appearance: colorless liquid	odor: stimulates pungent odor
Odor threshold: 0.5-1.0 ppm	Melting point/range: <-48℃
pH: not applicable, rapid hydrolysis in water	Boiling point/range: 100-101℃
Flammability: flammable liquid	Flash point: 10℃
Decomposition temperature: no data	Test method (open cup or closed cup): closed cup
Auto-ignition temperature: 421℃	Explosive limits: upper 12.5%; lower 2.1%
Vapor pressure: 28mmHg at 20°C	Vapor density:3.5 (air=1)
Relative density: 0.94 at 20°C	Solubility: 15.3g/L at 20°C
n-Octanol/Water Partition coefficient (log Kow): 1.38 at 20°C	Explosive properties: not explosive, but the mixture of vapor and air may be explosive
Oxidizing properties: no oxidation	
Molecular formula:$C_5H_8O_2$	Molecular weight:100.12

10.Stability and reactivity

Reactivity: no special hazardous reactions
Chemical stability: this product contains inhibitors, which is stable under normal conditions. When storage temperature exceeds the suggested value, the product will polymerize with evolution of heat.
Possibility of hazardous reactions: explosive polymerization will occur if this product is put together with oxidants (e.g., peroxides, nitrates), strong bases or acids, and metal catalysts (e.g., copper or iron).
Conditions to avoid: keep away from open flames, hot surfaces, sources of ignition, incompatible materials, metal catalysts (e.g., copper or iron), initiators of polymerization. Excess heat. Exposure to light. 參考其他SDS寫的，中文版跟上下欄位沒有差異
Incompatible materials: strong oxidants (e.g., peroxides, nitrates), heavy metal ions, radical initiators, acids, Bases, reducing agents 參考中文應避免情況補上酸鹼
Hazardous decomposition products: carbon monoxide (CO), carbon dioxide (CO_2)

11.Toxicological information

Route of exposure: skin, inhalation, ingestion, and eyes.	
symptom: Irritation, drowsiness, red skin, dizziness。	
Acute toxicity:	
Swallow:	LD50: 7872 mg/kg bw - Rat
Skin contact:	LD50: 5000 mg/kg bw - Rat
Inhale:	LC50 (4h): 29800 mg/m3 (Rat)
Skin corrosion/irritation:	causes skin and mucous membrane irritation - rabbit
Serious eye damage/irritation:	no eye irritation
Respiratory or skin sensitization:	may cause allergic skin reaction
Germ cell mutagenicity:	uncategorized
Carcinogenicity:	no data
Reproductive toxicity:	uncategorized
Specific target organ toxicity - single exposure: causes respiratory irritation	
Special target organ toxicity - repeated exposure: low risk for systemic toxicity	

Aspiration hazard:	no data
Chronic toxicity or long-term toxicity: (1) May cause dermatitis (2) Long-term exposure can cause skin irritation (3) May increase the frequency of headaches and cause ache over arms and legs, tiredness, restless sleeper, amnesia and anxiety Inhaled by 109g/m3/17M female rat (pregnant for 6-15 days) causes embryo poisoning	

12.Ecological information

Ecotoxicity:

Test node	Numerical value	Test species	method	Remarks
EC50-48h	69 mg/L	daphnia magna	similar to EPA OTS 797.1300	
EC50-72h	> 100 mg/L	algae	OECD 201	
LC50/EC50 -96h	>100 mg/L	fish	similar to EPA OTS 797.1400	
NOEC - 21d	37 mg/L	daphnia magna	OECD 211	
NOEC - 40d	9.4 mg/L	fish	OECD 210	
NOEC 72 h	110 mg/L	algae	OECD 201	

Persistence and degradability:
(1) Use mixed vaccine soil and sewage to show its biodegradability
(2) When the product is released to water, it will be volatile disappear
(3) When the product is released to air, it will degrade by reacting with the substances in the air. Its half-life is about 2.7 hours
half life (air) : 2.7 ~ 3 hours
half life (water surface) : 6.3 ~ 336 hours
half life (groundwater) : -
half life (soil) : -

Bioaccumulative potential: Log Kow = 1.38. Predict to be non-bioaccumulative。

Mobility in soil: when released in soil, it will volatilize and seep into the groundwater

PBT, vPvB Assessment: this substance contains no components considered to be PBT, or vPvB.

13.Disposal considerations

Disposal methods:
1. Dispose in accordance with current regulations
2. Use specific incineration or landfill
3. Valve will be blocked because vapors may accumulate around the valve or flame arrester of exhaust
4. Even empty containers may contain vapor and chemical residues, which cannot be reused

14.Shipping information

UN number: UN1247

UN Shipping Name: methyl methacrylate, stable

Transport hazard classification: Class III flammable liquid

Packaging group: II

Marine pollutants (yes/no):no

Special delivery methods and precautions: -

15.Regulatory information

Applicable regulations:
1. Regulations for the Occupational Safety and Health Equipments and Measures
2. Regulation of Labelling and Hazard Communication of Hazardous Chemicals

3. Standards of Permissible Exposure Limits at Job Site 4. Road Traffic Safety Regulations 5. Methods and Facilities Standards for the Storage, Clearance and Disposal of Industrial Waste 6. Establishment Standard and Safety Control Regulation for Manufacturing, Storing, Processing Public Hazardous Substances and Flammable Pressurized Gases Places 7. Occupational Safety and Health Act 8. Regulations to Prevent from the Intoxication of Organic Solvent

16.other information

References	1.CHEMINFO database, CCINFO CD, 2005-3 2.RTECS database, TOMES PLUS CD, Vol. 65, 2005 3.HSDB database, TOMES PLUS CD, Vol.65, 2005 4.Chem Watch database, 2005-1	
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