

Occupational Health Guideline for Methyl Acrylate

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $\text{CH}_2=\text{CHCOOCH}_3$
- Synonyms: Methyl propenoate
- Appearance and odor: Clear, colorless liquid with a sharp, sweet, and fruity odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl acrylate is 10 parts of methyl acrylate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 35 milligrams of methyl acrylate per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Methyl acrylate can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed.

• Effects of overexposure

1. *Short-term Exposure:* Overexposure to methyl acrylate may cause irritation of the eyes, nose, throat, and lungs. Death may be caused by lung damage from breathing high air levels or from swallowing it.

2. *Long-term Exposure:* Prolonged contact with the skin or eyes may result in severe damage.

3. *Reporting Signs and Symptoms:* A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to methyl acrylate.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to methyl acrylate at potentially hazardous levels:

1. *Initial Medical Screening:* Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from methyl acrylate exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of methyl acrylate might cause exacerbation of symptoms due to its irritant properties.

—Skin disease: Methyl acrylate is absorbed through the skin. It also is a defatting agent and can cause drying and cracking. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: Although methyl acrylate is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: Although methyl acrylate is not known as a kidney toxin in humans, the importance of this organ in the excretion of certain chemicals and their metabolites should be considered before exposing persons with impaired kidney function.

2. *Periodic Medical Examination:* Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

The vapor of methyl acrylate is irritating to the conjunctiva and upper respiratory tract. In moderate concentrations there are characteristic lacrimatory effects in man. Animals exposed to high concentrations show marked irritation of the eyes and of the respiratory tract, leading to pulmonary edema. The lowest concentration of vapor producing no significant effect in rodents is 30 ppm. Prolonged contact with the eye or the skin in animals causes severe damage. Skin sensitiza-

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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tion probably occurs, and fatal doses of the liquid are absorbed through the skin of animals exposed for 24 hours. There are no reports of injury to man from long-term exposure.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 86
2. Boiling point (760 mm Hg): 80 C (176 F)
3. Specific gravity (water = 1): 0.96
4. Vapor density (air = 1 at boiling point of methyl acrylate): 2.95
5. Melting point: -75 C (-103 F)
6. Vapor pressure at 20 C (68 F): 68.2 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 5.5

8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Heat and/or lack of appropriate inhibitor concentration can cause methyl acrylate to polymerize violently and burst container.

2. Incompatibilities: Contact with nitrates and other oxidizing materials, including peroxides and other initiators of polymerization, strong alkalis, and atmospheric moisture may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl acrylate.

4. Special precautions: Inhibitors do not function in absence of air, so inert gas blankets should not be used.

• Flammability

1. Flash point: -7.8 C (18 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 2.8; Upper: 25
4. Extinguishant: Dry chemical, foam, carbon dioxide

• Warning properties

1. Odor Threshold: The Manufacturing Chemists Association states that most persons can detect the odor of methyl acrylate at 20 ppm. "Odor detection has little practical value in chronic repeated exposures, since most workers become less sensitive to the odor and will tolerate atmospheric concentrations greater than the threshold limits."

2. Eye Irritation Level: The MCA states that "irritation of the eyes and mucous membranes is experienced beginning at about 75 ppm."

3. Evaluation of Warning Properties: Methyl acrylate has poor warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based

on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of methyl acrylate vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure methyl acrylate may be used. An analytical method for methyl acrylate is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid methyl acrylate.

• Clothing wet with liquid methyl acrylate should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of methyl acrylate from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the methyl acrylate, the person performing the operation should be informed of methyl acrylate's hazardous properties.

- Where there is any possibility of exposure of an employee's body to liquid methyl acrylate, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Any clothing which becomes wet with liquid methyl acrylate should be removed immediately and not reworn until the methyl acrylate is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid methyl acrylate may contact the eyes.

SANITATION

- Skin that becomes wet with liquid methyl acrylate should be immediately washed or showered to remove any methyl acrylate.
- Employees who handle liquid methyl acrylate should wash their hands thoroughly before eating or smoking.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to methyl acrylate may occur and control methods which may be effective in each case:

Operation	Controls
Use in preparation of thermoplastic coatings; use in manufacture of acrylic fibers; use in synthesis of higher acrylates; during preparation of adhesives and sealants based on methyl acrylate	Local exhaust ventilation; personal protective equipment
Use during polymerization in aqueous emulsions to produce resins for surface coatings and adhesives; use during polymerization in solutions to produce resins for surface coatings and adhesives	Local exhaust ventilation; personal protective equipment
Use during preparation of amphoteric surfactants for use in hair shampoos	Local exhaust ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If methyl acrylate gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If methyl acrylate gets on the skin, immediately flush the contaminated skin with water. If methyl acrylate soaks through the clothing, remove the clothing immediately and flush the skin with water. If there is skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of methyl acrylate, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible. Properly trained individuals may assist the affected person by administering 100% oxygen.

• Swallowing

When methyl acrylate has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.
- If methyl acrylate is spilled or leaked, the following steps should be taken:
 1. Remove all ignition sources.
 2. Ventilate area of spill or leak.
 3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Methyl acrylate should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
- Waste disposal methods:

Methyl acrylate may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill in an area where the odor will not be objectionable.
2. By atomizing in a suitable combustion chamber.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Methyl Acrylate," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- Deichmann, W. B., and Gerarde, H. W.: *Toxicology of Drugs and Chemicals*, Academic Press, New York, 1969.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- Manufacturing Chemists Association, Inc.: *Chemical Safety Data Sheet SD-79, Methyl Acrylate and Ethyl Acrylate* Washington, D.C., 1960.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.
- Suvorov, A. P.: "Results of Examinations Carried Out on Workers Exposed to Methyl Acrylate," *Gigiena Truda I Professional Nye Zabolenvanion*, 15:10, pp. 49-50, October 1971.

RESPIRATORY PROTECTION FOR METHYL ACRYLATE

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Vapor Concentration	
75 ppm or less	Any supplied-air respirator.** Any self-contained breathing apparatus.**
500 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
1000 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 1000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask with a full facepiece providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

**If eye irritation occurs, full-facepiece respiratory protective equipment should be used.