

Occupational Health Guideline for Methyl Acetate

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: $\text{CH}_3\text{COOCH}_3$
- Synonyms: Acetic acid methyl ester; methyl acetic ester; methyl ethanoate
- Appearance and odor: Colorless liquid with a fruity odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl acetate is 200 parts of methyl acetate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 610 milligrams of methyl acetate per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Methyl acetate 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 acetate may cause irritation of the nose, throat, and eyes. Headache, drowsiness, and unconsciousness are also possible. (Several cases of disturbance of vision have been reported from overexposure to this chemical).

2. *Long-term Exposure:* Prolonged overexposure may cause irritation of the skin.

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 acetate.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to methyl acetate 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 acetate exposure.

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

—Skin disease: Methyl acetate is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: Although methyl acetate 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 acetate 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 acetate is mildly irritating to the upper respiratory tract and, in higher concentrations, to the eyes. Upon absorption, methyl acetate may be hydrolyzed with the liberation of methanol. The systemic effects, especially the chronic effects, may therefore be similar to those of methanol, and could include atrophy of the optic nerve. Animals exposed to concentrations of approximately 10,000 ppm showed narcosis leading to death in some. Chronic poisoning of animals

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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

by inhalation resulted in pulmonary edema and changes in liver, kidney, and myocardium. Liquid methyl acetate in the eye causes inflammation.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 74
2. Boiling point (760 mm Hg): 57 C (135 F)
3. Specific gravity (water = 1): 0.94
4. Vapor density (air = 1 at boiling point of methyl acetate): 2.8
5. Melting point: -98 C (-144 F)
6. Vapor pressure at 20 C (68 F): 173 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 24.5
8. Evaporation rate (butyl acetate = 1): 11.8

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalis, and strong acids 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 acetate.

4. Special precautions: None

• Flammability

1. Flash point: -10 C (14 F) (closed cup)
2. Autoignition temperature: 502 C (935 F)
3. Flammable limits in air, % by volume: Lower: 3.1; Upper: 16
4. Extinguishant: Dry chemical, alcohol foam, carbon dioxide

• Warning properties

1. Odor Threshold: Summer and May report that the odor threshold of methyl acetate is 200 ppm.
2. Eye Irritation Level: According to Grant, "the vapor at a concentration of 10,000 ppm in air causes irritation of the eyes, nose, and throat in human beings, also in cats." Sax also reports that "the irritant concentration is about 10,000 ppm."
3. Evaluation of Warning Properties: Since the odor threshold of methyl acetate is at the TLV, it is treated as a material with good 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 acetate 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 acetate may be used. An analytical method for methyl acetate 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). 935).

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 repeated or prolonged skin contact with liquid methyl acetate.
- Clothing wet with liquid methyl acetate should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of methyl acetate from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the methyl acetate, the person performing the operation should be informed of methyl acetate's hazardous properties.
- Any clothing which becomes wet with liquid methyl acetate should be removed immediately and not reworn until the methyl acetate is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid methyl acetate may contact the eyes.

SANITATION

- Skin that becomes wet with liquid methyl acetate should be promptly washed or showered to remove any methyl acetate.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use during preparation of methyl acetone, including methylacetate, methanol, and acetone for use as solvents	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a solvent for nitrocellulose and cellulose acetate	General dilution ventilation; personal protective equipment
Liberation during use as a chemical intermediate	General dilution ventilation
Use during spraying of lacquers, paint thinners, and vinyl resin coatings; use of paint removers	Local exhaust ventilation; personal protective equipment
Liberation during preparation of paint removers and lacquer solvents	Local exhaust ventilation; general dilution ventilation
Liberation during preparation of methylacetate or recovery as a by-product from wood carbonization	Local exhaust ventilation
Use during preparation of artificial leather	Local exhaust ventilation; personal protective equipment
Liberation during formulation of lacquers, paints, perfumes, and any vinyl resin coatings	Local exhaust ventilation

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 acetate 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 acetate gets on the skin, promptly flush the contaminated skin with water. If methyl acetate soaks through the clothing, remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of methyl acetate, 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.

• Swallowing

When methyl acetate 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 acetate 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 acetate should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Methyl acetate may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Methyl Acetate," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- American Industrial Hygiene Association: "Methanol," *Hygienic Guide Series*, Detroit, Michigan, 1965.
- American Industrial Hygiene Association: "Methyl Acetate," *Hygienic Guide Series*, Detroit, Michigan, 1965.
- Browning, E.: *Toxicity and Metabolism of Industrial Solvents*, Elsevier, New York, 1965.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.
- May, J.: "Solvent Odor Thresholds for the Evaluation of Solvent Odors in the Atmosphere," *Staub-Reinhalt*, 26:9, 385-389, 1966.
- 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.
- Smyth, H. F., and Carpenter, C. P.: "Chemical Burns of the Rabbit Cornea," *American Journal of Ophthalmology*, 29:1363-72, 1946.
- Summer, W.: *Odor Pollution of Air: Causes and Control*, L. Hill, London, 1975.
- von Oettingen, W. F.: "The Aliphatic Acids and Their Esters: Toxicity and Potential Dangers," *A.M.A. Archives of Industrial Health*, 21:28-65, 1960.

RESPIRATORY PROTECTION FOR METHYL ACETATE

Condition	Minimum Respiratory Protection* Required Above 200 ppm
Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s). Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
5000 ppm or less	A gas mask with a chin-style organic vapor canister.
10,000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. A powered air-purifying chemical cartridge respirator with an organic vapor cartridge. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. 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 10,000 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 providing protection against organic vapors. Any escape self-contained breathing apparatus.

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

