

Occupational Health Guideline for Isoamyl 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: $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$
- Synonyms: Banana oil; 3-methyl-1-butanol acetate; 2-methylbutyl ethanoate
- Appearance and odor: Clear, colorless liquid with a banana-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for isoamyl acetate is 100 parts of isoamyl acetate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 525 milligrams of isoamyl acetate per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Isoamyl 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 isoamyl acetate may cause irritation of the eyes, nose, and throat. Overexposure may also cause headache, drowsiness, and unconsciousness.

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 isoamyl acetate.

• Recommended medical surveillance

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

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

—Skin disease: Isoamyl 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.

—Kidney disease: Although isoamyl acetate is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with possible impairment of renal function.

—Liver disease: Although isoamyl 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.

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

• Summary of toxicology

The toxicologic effects of isoamyl acetate are probably similar to those of amyl acetate: chiefly irritation of the conjunctiva and upper respiratory tract, followed by gradual onset of narcosis, with slow recovery after exposure ceases. Men exposed to 950 ppm for 30 minutes reported only irritation of the nose and throat, headache, and weakness; cats exposed to 1900 ppm for 2 to 3 hours per day for a week showed only irritation, weakness, and loss of weight; dogs exposed to 5000 ppm

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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for 1 hour had nasal irritation and drowsiness. No chronic systemic effects have been reported in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 130.2
2. Boiling point (760 mm Hg): 145.6 C (294 F)
3. Specific gravity (water = 1): 0.87
4. Vapor density (air = 1 at boiling point of isoamyl acetate): 4.5
5. Melting point: -100 C (-148 F)
6. Vapor pressure at 20 C (68 F): 4 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.2
8. Evaporation rate (butyl acetate = 1): 0.42

• 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 isoamyl acetate.

4. Special precautions: None

• Flammability

1. Flash point: 25 C (77 F) (closed cup)
2. Autoignition temperature: 360 C (680 F)
3. Flammable limits in air, % by volume: Lower: 1.0 (at 100 C (212 F)); Upper: 7.5
4. Extinguishant: Dry chemical, carbon dioxide, foam

• Warning properties

1. Odor Threshold: By analogy to amyl acetate, which has an odor threshold of 7 ppm (*Handbook of Industrial Organic Solvents*), the odor of isoamyl acetate is assumed to be detectable below the permissible exposure limit (100 ppm).

2. Eye Irritation Level: The *Handbook of Industrial Organic Solvents* indicates that significant eye and nose irritation does not occur below the threshold limit.

3. Other Information: According to the *Documentation of TLV's*, the "threshold limit of 100 ppm is recommended to prevent significant irritation of the respiratory passages."

4. Evaluation of Warning Properties: For the purposes of this guideline, isoamyl acetate 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 isoamyl 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 isoamyl acetate may be used. An analytical method for isoamyl 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).

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 isoamyl acetate.

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

• Any clothing which becomes wet with liquid isoamyl acetate should be removed immediately and not reworn until the isoamyl acetate is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid isoamyl acetate may contact the eyes.

SANITATION

- Skin that becomes wet with liquid isoamyl acetate should be promptly washed or showered with soap or mild detergent and water to remove any isoamyl acetate.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls	Operation	Controls
Liberation during spray application of varnishes and nitrocellulose lacquers as protective and finish coatings for wood, especially in furniture industry, and on plastic, metal leather, and other surfaces	Local exhaust ventilation; personal protective equipment	Liberation during manufacture of shoe polish and furniture polish; during fermentation of whiskey grains	General dilution ventilation
Liberation during application of varnishes and nitrocellulose lacquers as protective and finish coatings for wood, paper, metal, leather, and other surfaces by dipping, roller coating, tumbling, knifing, or brushing	General dilution ventilation; local exhaust ventilation	Liberation during manufacture of cellulosic photographic film by formation from solvent solutions	General dilution ventilation; local exhaust ventilation
Liberation during air or oven-drying of varnishes and lacquers	General dilution ventilation	Liberation during preparation of perfumes, foods, and other materials for use as flavoring or odorant	General dilution ventilation
Liberation during application of cellulosic adhesives by machine spraying, dipping, roller coating, tumbling, knifing, or brushing in shoe manufacturing, book binding, packaging, leather processing, paper processing, and textile	General dilution ventilation; local exhaust ventilation	Liberation during use as an extractant in purification of pharmaceuticals, including penicillin	General dilution ventilation; local exhaust ventilation
Liberation during manual application of cellulosic adhesives, including household cements	General dilution ventilation; local exhaust ventilation; personal protective equipment	Liberation during cleaning and maintenance of acetate-processing equipment, such as kettles, distillation columns, and storage vessels	Personal protective equipment
		Liberation during manufacture of bath sponges	General dilution ventilation
		Liberation during manufacture of artificial leathers	General dilution ventilation; local exhaust ventilation
		Liberation during manufacture of artificial silk, rayon, and pearls; during manufacture and use of bronzing fluids	General dilution ventilation; local exhaust ventilation
		Liberation during use in dry cleaning preparations	General dilution ventilation
		Use in treating of natural leathers by tanning	General dilution ventilation; local exhaust ventilation; personal protective equipment

Liberation during drying, dry printing, and other finishing processes for textiles; during application of phosphorus in manufacture of fluorescent lamps

General dilution ventilation; 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 isoamyl 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 isoamyl acetate gets on the skin, promptly flush the contaminated skin with water. If isoamyl acetate 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 isoamyl 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 isoamyl 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 isoamyl 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. Isoamyl acetate should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Isoamyl 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

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RESPIRATORY PROTECTION FOR ISOAMYL ACETATE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s). Any supplied-air respirator. Any self-contained breathing apparatus.
3000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 3000 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.

