

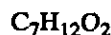
OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR BUTYL ACRYLATE

INTRODUCTION

This guideline summarizes pertinent information about butyl acrylate for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

2-Propenoic acid, butyl ester; acrylic acid, butyl ester; acrylic acid, n-butyl ester; butyl 2-propenoate

• Identifiers

1. CAS No.: 141-32-2
2. RTECS No.: UD3150000
3. DOT UN: 2348 26 (for the inhibited form)
4. DOT label: Flammable Liquid

• Appearance and odor

Butyl acrylate is a flammable, clear, colorless liquid with a sharp, fragrant, characteristic odor. The odor threshold is reported to be 0.1 part per billion (ppb) parts of air. Butyl acrylate is highly reactive and can undergo spontaneous polymerization. To prevent premature polymerization, the commercially available product often contains an inhibitor.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 128.17
2. Boiling point (760 mm Hg): 145°C (293°F) (polymerizes)
3. Specific gravity (water = 1): 0.9 at 20°C (68°F)
4. Vapor density (air = 1 at boiling point of butyl acrylate): 4.4
5. Melting point: -64°C (-83.2°F)
6. Vapor pressure at 20°C (68°F): 4 mm Hg
7. Solubility: Very slightly soluble in water; soluble in alcohol, ether, and acetone.
8. Evaporation rate (butyl acetate = 1): 0.42

• Reactivity

1. Conditions contributing to instability: Heat, sparks, and open flame (heat may cause an explosive polymerization reaction)
2. Incompatibilities: Hazardous polymerization may result from contact of butyl acrylate with peroxides, sunlight, or other catalysts. Butyl acrylate is incompatible with strong acids, strong alkalis, amines, halogens, hydrogen compounds, and oxidizers.
3. Hazardous decomposition products: Toxic gases (such as carbon dioxide and carbon monoxide) may be released in a fire involving butyl acrylate.
4. Special precautions: None

• Flammability

The National Fire Protection Association has assigned a flammability rating of 2 (moderate fire hazard) to butyl acrylate.

1. Flash point: 49°C (120°F) (open cup)
2. Autoignition temperature: 293°C (559°F)
3. Flammable limits in air (% by volume): Lower, 1.4; upper, 9.9

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Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health
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4. Extinguishant: Use dry chemical, foam, or carbon dioxide to fight fires involving butyl acrylate. Water may be used to cool fire-exposed containers. If a leak or spill has not ignited, water spray may be used to disperse vapors and to protect persons attempting to stop the leak.

Fires involving butyl acrylate should be fought upwind and from the maximum distance possible. Isolate the hazard area and deny access to unnecessary personnel. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Vapor explosion and poison hazards may occur indoors, outdoors, or in sewers. Vapors may travel to a source of ignition and flash back. Containers of butyl acrylate may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool containers from the sides with water until well after the fire is out. Stay away from the ends of containers. Personnel should withdraw immediately if they hear a rising sound from a venting safety device or if a container becomes discolored as a result of fire. Dikes should be used to contain fire-control water for later disposal. If a tank car or truck is involved in a fire, personnel should isolate an area of a half mile in all directions. Firefighters should wear a full set of protective clothing (including a self-contained breathing apparatus) when fighting fires involving butyl acrylate. Firefighters' protective clothing may not provide protection against permeation by butyl acrylate.

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for butyl acrylate is 10 ppm (55 mg/m³) as an 8-hr time-weighted average (TWA) concentration [29 CFR 1910.1000, Table Z-1-A].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 10 ppm (55 mg/m³) as an 8-hr TWA [NIOSH 1992].

• ACGIH TLV®

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned butyl acrylate a threshold limit value (TLV) of 10 ppm (52 mg/m³) as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1991b].

• Rationale for limits

The limits are based on the risk of eye and skin irritation associated with exposure to butyl acrylate and on its toxicological similarity to methyl acrylate.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to butyl acrylate can occur through inhalation, eye or skin contact, and absorption through the skin.

• Summary of toxicology

1. *Effects on Animals:* Butyl acrylate is an irritant of the eyes, skin, and respiratory tract in animals. Instillation of this substance into the eyes of rabbits also caused mild to moderate irritation [NIOSH 1991]. Corneal necrosis occurred when ocular washing was not performed [ACGIH 1991a]. When applied to the skin of rabbits for 24 hr, 10 mg butyl acrylate caused mild irritation. Butyl acrylate is a sensitizer in guinea pigs, and sensitized animals showed cross-sensitization reactions to other monoacrylates [IARC 1986]. The dermal LD₅₀ for rabbits has ranged from 1,800 to 3,000 mg/kg [Carpenter et al. 1974; Smyth et al. 1951]. The maximum duration that all rats survived exposure to inhalation of saturated vapors (7,050 ppm) was 30 min [ACGIH 1991a; Smyth et al. 1951]. The 2-hr LC₅₀ is 1,345 ppm for mice and 6,035 ppm for rats [Izmerov et al. 1982]. The 4-hr LC₅₀ in rats is 2,730 ppm [NIOSH 1991]. These animals exhibited signs of eye and respiratory tract irritation (e.g., corneal necrosis and labored breathing) [ACGIH 1991a; Proctor et al. 1988]. Wide variations are reported in the oral LD₅₀ for rats: 900 mg/kg [Izmerov et al. 1982]; 3,730 mg/kg [Smyth et al. 1951]; and 8,050 mg/kg [Carpenter et al. 1974]. The oral LD₅₀ in mice has ranged from 5,400 to 7,500 mg/kg [IARC 1986]. Rats were exposed for 6 hr/day to 25, 135, or 250 ppm on days 6 to 15 after mating. Maternal toxicity and embryo lethality occurred at the two highest doses, but exposure to 25 ppm caused no observable effects. However, terata were not induced by any concentration of butyl acrylate [Proctor et al. 1988]. The International Agency for Research on Cancer (IARC) found no evidence of mutagenic potential in the in vivo or in vitro data reviewed [IARC 1986]. In a dermal carcinogenesis study, 1% butyl acrylate in acetone was applied three times weekly to the skin of mice over their lifetimes; no site-of-application tumors occurred in these animals [Proctor et al. 1988]. In a 2-year inhalation study, Sprague-Dawley rats were exposed to butyl acrylate concentrations ranging from 15 to 135 ppm. Exposures were for 6 hr/day, 5 days/week for 24 months followed by a 6-month recovery period. No tumors were induced by butyl acrylate after either the treatment or recovery periods [IARC 1986]. IARC has concluded that there is inadequate evidence of the carcinogenicity of butyl acrylate in animals [IARC 1986].

2. *Effects on Humans:* Butyl acrylate is an irritant of the eyes and skin as well as the mucous membranes of the nose, throat, and respiratory tract in humans [Gosselin et al. 1984]. Allergic contact dermatitis attributed to butyl acrylate has

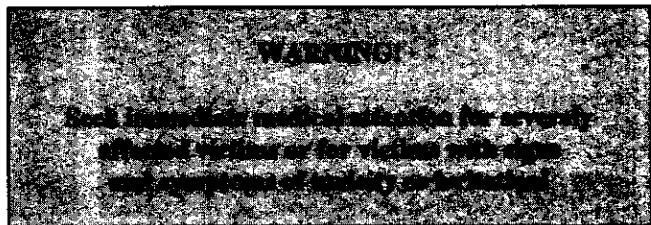
been reported in dentists, dental technicians, paint stock room clerks, and other occupationally exposed individuals [Kanerva et al. 1988; Proctor et al. 1988]. Fourteen of 33 workers exposed to 50 mg/m³ (approximately 10 ppm) for an average of 5 years reported experiencing nervous system and behavioral symptoms, but these were not confirmed by electroencephalography [IARC 1986]. IARC classified butyl acrylate as a Group 3 material (not classifiable as to its carcinogenicity to humans) [IARC 1987].

• Signs and symptoms of exposure

1. *Acute exposure:* Acute exposure to butyl acrylate vapor can cause redness, tearing, and irritation of the eyes, runny nose, scratchy throat, difficult breathing, and redness and cracking of the skin.

2. *Chronic exposure:* Repeated contact of the skin with this substance may cause skin sensitization in some individuals, with redness, swelling, itching, and oozing of the affected areas. Nervous system and behavioral effects are also possible.

• Emergency procedures



Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Tissue irritation may result from exposure to concentrated solutions, vapors, mists, or aerosols of butyl acrylate. **Immediately and thoroughly** flush eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* Skin irritation may result. **Immediately** remove contaminated clothing and **thoroughly** wash contaminated skin with soap and water.

3. *Inhalation exposure:* If vapors, mists, or aerosols of butyl acrylate are inhaled, move the victim to fresh air **immediately**.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if butyl acrylate or a solution containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do **not** force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve butyl acrylate and may result in worker exposures to this substance:

—Manufacture of polymers and resins for leather finishes, paint formulations, and textiles

—Organic synthesis of polymers and copolymers for solvent coatings, paper, adhesives, binders, sealants, and emulsifiers

The following methods are effective in controlling worker exposures to butyl acrylate, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. Industrial ventilation—a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

2. Burton DJ [1986]. Industrial ventilation—a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.

4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.

5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to butyl acrylate, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the skin and respiratory tract. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to butyl acrylate at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history of allergies or other findings consistent with skin or respiratory tract diseases.

• Periodic medical examinations and biological monitoring

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to

5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to butyl acrylate exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of butyl acrylate on the skin and respiratory tract. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for butyl acrylate.

• Medical examinations recommended at the time of job transfer or termination

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne butyl acrylate is determined by using two XAD-2 tubes in series (80/50-mg sections, 20/50 mesh). Samples are collected at a maximum flow rate of 0.1 liter/min until a maximum air volume of 3 liters is collected. The sample is then treated with carbon disulfide to extract the butyl acrylate. Analysis is conducted by gas chromatography using a flame ionization detector. This method is included in the OSHA Laboratory In-House Methods File [OSHA 1989].

PERSONAL HYGIENE

If butyl acrylate contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 min and then wash with soap and water.

Clothing and shoes contaminated with butyl acrylate should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering contaminated clothing should be informed of the hazardous properties of butyl acrylate, particularly its potential for causing skin irritation and sensitization.

A worker who handles butyl acrylate should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where butyl acrylate or a solution containing butyl acrylate is handled, processed, or stored.

STORAGE

Butyl acrylate should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. The inhibitor concentration in containers of this substance should be checked at regular intervals and inhibitor should be added as needed. Butyl acrylate should be stored at temperatures below 38°C (100°F). Containers of butyl acrylate should be protected from physical damage and should be stored separately from peroxides, strong acids, strong alkalis, amines, halogens, hydrogen compounds, oxidizers, sunlight, heat, sparks, and open flame. Because containers that formerly contained butyl acrylate may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving butyl acrylate, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate potentially explosive atmospheres.
5. Water spray may be used to reduce vapors, but the spray may not prevent ignition in closed spaces.
6. Absorb small liquid spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.
7. For large liquid spills, build dikes far ahead of the spill to contain the butyl acrylate for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

• Emergency planning requirements

Butyl acrylate is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

• Reportable quantity requirements for hazardous releases

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the National Response Center of an accidental release of butyl acrylate; there is no reportable quantity for this substance.

• Community right-to-know requirements

Employers who own or operate facilities in SIC codes 20 to 39, who employ 10 or more workers, and who manufacture 25,000 lb or more or otherwise use 10,000 lb or more of butyl acrylate per calendar year are required by EPA [40 CFR 372.30] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of butyl acrylate emitted or released from their facility annually.

• Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although butyl acrylate is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

• Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of

respirators to control exposure. Respirators must be worn if the ambient concentration of butyl acrylate exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

• Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective clothing should be worn to prevent skin contact with butyl acrylate; impervious gloves are recommended. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. Teflon[®] has been tested against permeation by butyl acrylate and has demonstrated good-to-excellent resistance for more than 4 but fewer than 8 hr. Butyl rubber, natural rubber, neoprene, nitrile rubber, polyvinyl chloride, and Viton[®] have demonstrated poor resistance to permeation by butyl acrylate.

If butyl acrylate is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which butyl acrylate might contact the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or

skin contact with butyl acrylate. Contact lenses should not be worn if the potential exists for butyl acrylate exposure.

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