

Methyl Methacrylate

80-62-6

Hazard Summary

Methyl methacrylate is used in the manufacture of resins and plastics. Methyl methacrylate is irritating to the skin, eyes, and mucous membranes in humans. An allergic response to dermal exposure may develop. Respiratory effects have been reported in humans following acute (short-term) and chronic (long-term) inhalation exposures. Respiratory symptoms observed following acute exposures include chest tightness, dyspnea, coughing, wheezing, and reduced peak flow. Neurological symptoms have also been reported in humans following acute exposure to methyl methacrylate. Fetal abnormalities have been reported in animals exposed to methyl methacrylate by injection and inhalation. EPA considers methyl methacrylate not likely to be carcinogenic to humans.

Please Note: The main sources of information for this fact sheet are EPA's Toxicological Review of Methyl Methacrylate (7) and Health and Environmental Effects Profile for Methyl Methacrylate. (2)

Uses

- Methyl methacrylate is used in the manufacture of methacrylate resins and plastics (e.g., Plexiglas). (1,4,7,11)
- The principal uses of methyl methacrylate are: cast sheet and other grades (advertising signs and displays, lighting fixtures, glazing and skylights, building panels and sidings, and plumbing and bathroom fixtures), molding/extrusion powder, and coatings (latex paints, lacquer, and enamel resins). (2)
- Methyl methacrylate is used in the impregnation of concrete to make it water-repellent, and also has uses in the fields of medicine and dentistry to make prosthetic devices and as a ceramic filler or cement. (1)

Sources and Potential Exposure

- Exposure to methyl methacrylate is primarily occupational, through dermal and inhalation routes. Potential for exposure exists for employees of manufacturers of methyl methacrylate and its polymers, as well as doctors, nurses, dentists, and dental technicians. (1,7)
- Individuals may also be exposed to methyl methacrylate via consumption of contaminated water. (2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to methyl methacrylate.

Health Hazard Information

Acute Effects:

- Methyl methacrylate is irritating to the skin, eyes, and mucous membranes in humans. An allergic response to dermal exposure may develop. (2-4)
- Respiratory symptoms reported in humans include chest tightness, dyspnea, coughing, wheezing, and reduced peak flow. (7)

- Neurological symptoms, including headache, lethargy, lightheadedness, and sensation of heaviness in arms and legs, have occurred in humans following acute exposure to methyl methacrylate. (1,7)
- In mice and rats acutely exposed to high concentrations of methyl methacrylate by inhalation, degenerative olfactory changes in the nasal passages and lung damage have been observed. High doses of methyl methacrylate may cause pulmonary edema. (2,7)
- Acute oral exposure of animals to methyl methacrylate has caused damage to the liver. (2,7)
- Tests involving acute exposure of rats, mice, rabbits, and guinea pigs have demonstrated methyl methacrylate to have **low** to **moderate** acute toxicity by inhalation or oral exposure. (5)

Chronic Effects (Noncancer):

- Respiratory and nasal symptoms and reduced lung function have been reported in chronically exposed workers. (7)
- In one study, occupational exposure to high doses of methyl methacrylate was associated with cardiovascular disorders in humans. (2)
- Chronic inhalation of methyl methacrylate by rats has resulted in respiratory effects (e.g., inflammation of the nasal cavity, degeneration/loss of olfactory epithelium in nasal turbinates, and lung congestion). Chronic inhalation of high levels of methyl methacrylate has resulted in degenerative and necrotic changes in the liver, kidney, brain, spleen, and bone marrow, decreased body weight gain, listlessness, prostration, and ocular and nasal discharge in animals. (3,7)
- EPA has calculated a Reference Concentration (RfC) for methyl methacrylate of 0.7 milligrams per cubic meter (mg/m^3) based on respiratory effects in rats. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. (6,7)
- EPA has medium to high confidence in the RfC based on: (1) high confidence in the principal study because it was a long-term inhalation study performed with large group sizes, with additional histopathological analyses, described effects to the target organ well, and identified a no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL); and (2) medium to high confidence in the database because developmental studies were performed in two species, with effects observed only in offspring at levels more than 10-fold higher than the LOAEL for the critical effect, and no multigenerational reproductive studies are available. (6,7)
- EPA has calculated a Reference Dose (RfD) of 1.4 milligrams per kilogram body weight per day ($\text{mg}/\text{kg}/\text{d}$) based on no adverse effects in rats. (6,7)
- EPA has low to medium confidence in the RfD based on: (1) low to medium confidence in the principal study because it was not conducted in accordance with Good Laboratory Practice and did not identify a LOAEL, and (2) low to medium confidence in the database because quantitative human subchronic or chronic studies are not available and although repeat exposure inhalation studies (including developmental, reproductive, and chronic studies) bolster the weak and dated oral database somewhat, no developmental or reproductive studies by the oral route are available and no multigenerational studies are available by any route of exposure. (6,7)

Reproductive/Developmental Effects:

- No adequate reproductive or developmental studies in humans are available.
- Inhalation exposure of rats to maternally-toxic levels of methyl methacrylate resulted in fetal abnormalities (hematomas and skeletal anomalies) and decreased fetal weight and crown-rump length. (2,7)

Cancer Risk:

- From a retrospective epidemiology study, a causal relationship between occupational exposure and increased incidences of colon and rectal cancers has been suggested; however, the causal relationship

could not be established when relative accumulated total exposures and latency were considered. (2,7)

- No carcinogenic effects were observed in several inhalation and oral animal studies. (2,7)
- EPA considers methyl methacrylate not likely to be carcinogenic to humans. (6,7)

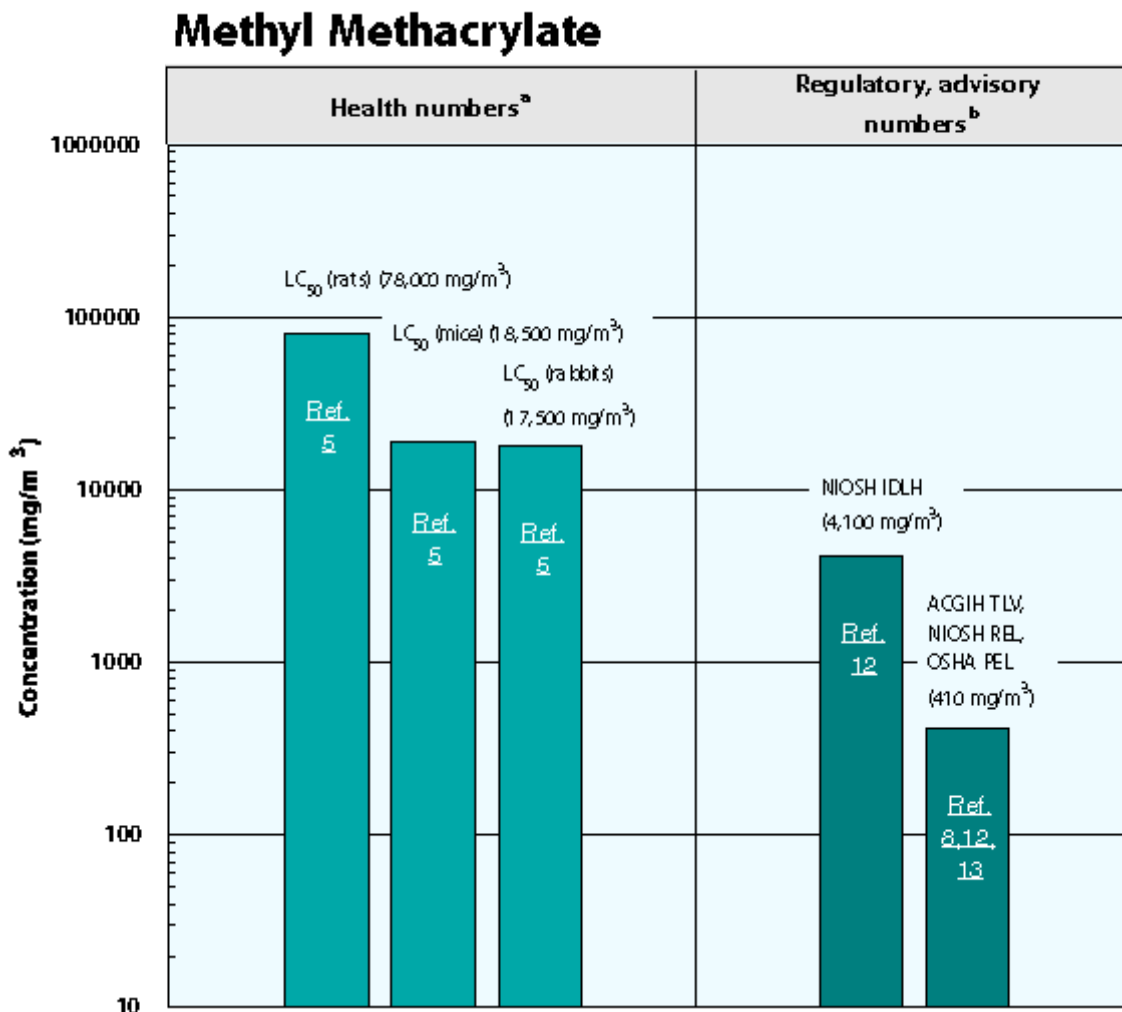
Physical Properties

- The chemical formula for methyl methacrylate is $C_5H_8O_2$, and it has a molecular weight of 100.1 g/mol. (2,9)
- Methyl methacrylate is a colorless, volatile, flammable liquid that is soluble in warm water. (2,7)
- Methyl methacrylate has an acrid, repulsive odor with an odor threshold of 0.08 parts per million (ppm) (0.3 mg/m^3). (2,10)
- The vapor pressure for methyl methacrylate is 29.3 mm Hg at 20 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 0.79. (2)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m^3 : $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$. For methyl methacrylate: 1 ppm = 4.09 mg/m^3 .

Health Data from Inhalation Exposure



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse

effects.

LC₅₀ (Lethal Concentration₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

References

Summary created in April 1992, updated January 2000

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