1,1,1-TRICHLOROETHANE

(METHYL CHLOROFORM)

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1. Commercial 1,1,1-trichloroethane is one of many available chlorinated hydrocarbons. It has its own chemical, physical, and toxic properties. It must not be confused with or thought to have the same properties as either 1,1,2-trichloroethane or trichloroethylene, which have similar-sounding names.

Physical Properties

2. Some of the physical properties of 1,1,1-trichloroethane are given in the following list:

This Data Sheet is one of a series published by the National Safety Council, reflecting experience from many sources. Not every acceptable procedure is necessarily included. Data Sheets should not be confused with American Standard Safety Codes, federal laws, insurance requirements, state laws, rules and regulations, or municipal ordinances.

3. The solvency of 1,1,1-trichloroethane is similar to that of carbon tetrachloride. The Kauri-Butanol number is 124.

4. The material is insoluble in water but miscible with alcohol and ether.

Physical Properties	Uninhibited Grade	Typical Inhibited Grade
Formula	CH_3CCl_3	
Molecular weight	133.42	
Freezing point	—32.7 C (—26.9 F)	—50 C (—58.0 F)
Boiling range (atm. press.)	73-75 C(163.4-167 F)	72-88 C (161.6-190.4 F)
Specific gravity at 25/25 C	1.336-1.338	1.318-1.320
Specific gravity at 60/60 F	1.351-1.353	1.331-1.333
Pounds per gallon at 25 C	11.16	11.01
Refractive index at 25 C	1.436-1.438	1.432-1.434
Viscosity at 25 C, centipoises	. . . . .	0.79
Flash point	None	None
Fire point	None	None
Vapor pressure at 28 C (82.4 F)	150 mm Hg	150 mm Hg
Evaporation rate at 24.4 C (76 F)	0.595 gal/sq ft/day	0.555 gal/sq ft/day

Chemical Properties

5. Since uninhibited 1,1,1- trichloroethane will readily corrode aluminum and aluminum alloys, it must not be permitted to come in contact with aluminum cans, tanks, screens, or other aluminum parts.

6. Inhibited 1,1,1-trichloroethane, which is available under several different trade names, may be used in contact with aluminum.

7. The inhibitors are designed primarily to control corrosion of aluminum and its alloys under ordinary conditions. Tests with one of the inhibited grades of 1,1,1-trichloroethane at room temperature showed negligible corrosion on common metals, such as aluminum, brass, copper, iron, Monel, steel, tin, and zinc.

8. Tests of this inhibited grade at its boiling point with any of the mentioned common metals immersed under the solvent showed negligible corrosion. Also, except for zinc and aluminum, which are readily corroded, these same metals show negligible corrosion when suspended in the vapor phase above the boiling solvent.

9. The inhibitors are not designed to prevent hydrolysis at higher temperatures.

10. When heated, 1,1,1-trichloroethane does not form significant amounts of phosgene. When passed over iron at 635 F, 1,1,1-trichloroethane produced less than 1/350 as much phosgene as did carbon tetrachloride under the same conditions; at 405 F, 1/550; at 540 F, 1/492.

11. 1,1,1-trichloroethane is an excellent solvent for oils, greases, tars, and waxes.

Uses

12. Inhibited 1,1,1-trichloroethane is used for cold cleaning, such as dip cleaning, bucket cleaning, wipe cleaning, spray cleaning, and electrical equipment cleaning. It is also used in aerosols, as a spot remover for fabrics, and as an adhesive solvent and activator.

13. Under no circumstances is it recommended as a fire extinguishing agent. It is not recommended for general vapor degreasing, even though it has been successfully used for this purpose under controlled conditions.

Containers

14. Inhibited 1,1,1-trichloroethane should be shipped in black iron drums. Aluminum drums, tanks, or other containers fitted with aluminum closures, screens, or other parts, should not be used, even for the inhibited materials.

15. The recommended warning label of the Manufacturing Chemists' Association should be displayed on all containers.

Shipping and Storage

16. There are no specific shipping regulations provided by the Interstate Commerce Commission.

17. It is recommended that protection from moisture be provided for bulk storage and that the material not be stored in aluminum.

Ventilation

18. The maximum acceptable concentration for 1,1,1-trichloroethane is 500 ppm according to the American Conference of Governmental Industrial Hygienists. If the solvent is not heated above room temperature, general ventilation probably would maintain that value for a small exposed area. For a large area, local exhaust ventilation will probably be required. If it is desired to calculate the amount of ventilation required, the accompanying equation can be used, preferably applying a safety factor of two or three in order to be safe because of the unpredictability of general ventilation.

EQUATION FOR CALCULATING VENTILATION REQUIRED

$$V = \frac{403 \times 1.32 \times 1{,}000{,}000 \times \text{pints solv lost/hr}}{133.5 \times 500}$$

where

V = cubic feet of dilution per hour
132 = specific gravity of solvent
133.5 = molecular weight of solvent
500 = parts per million

Fire Hazards and Electrical Equipment

19. The flammability characteristics of 1,1,1-trichloroethane are the same range as those of trichloroethylene. It has no flash or fire point by the Cleveland open-cup method. When the vapors are exposed to open flames, irritating and toxic gases may be formed.

20. No special precautions are required so far as electrical equipment is concerned. However, 1,1,1-trichloroethane may damage some electrical insulations upon prolonged immersion.

Toxic Properties

21. Like most other commonly used solvents, 1,1,1-trichloroethane after prolonged and repeated contact with the skin can cause a dermatitis. Occasional contacts of short duration should not cause skin irritation.

22. Introduction of the undiluted material into the eyes will cause pain and irritation.

23. Taken orally, 1,1,1-trichloroethane is moderately toxic. The oral minimum lethal dose for dogs is 750 mg/kg, with death in 24 hours. Accidental or willful swallowing of substantial quantities could result in serious illness.

24. 1,1,1-Trichloroethane vapor when inhaled is capable of causing anesthetic effects but is not likely to cause appreciable organic injury as a result of vapor exposure. These are predictions from animal experiments. There is no known case of human injury.

25. The material may be adsorbed through the skin, but probably not in amounts sufficient to produce toxic effects.

Personal Protective Equipment

26. Impervious gloves may be needed for jobs that require immersion of the hands in the solvent. Natural rubber gloves will be attacked to some degree by the solvent. Synthetic rubber or plastic-coated gloves give the best protection. Gloves should be discarded as soon as signs of deterioration appear.

27. Eye protection may be required, ranging from cover-type goggles to cup-type goggles, depending upon the degree of exposure expected. Accidental splashing of the solvent in the eyes can cause pain and irritation.

28. If large surfaces of 1,1,1-trichloroethane are exposed to air or if ventilation is limited, gas masks approved by the U. S. Bureau of Mines for organic vapor should be available, and personnel should be trained in their use.

29. A self-contained breathing apparatus or a hose mask will be required for entering tanks which

contain 1,1,1-trichloroethane. Regular tank-entering procedures should be followed in all such work.

Symptoms of Poisoning

30. The symptoms of poisoning in order of increasing severity are impaired coordination, dizziness, sleepiness, mental dullness, and unconsciousness.

First Aid

31. If a person should be overcome by 1,1,1-trichloroethane, the following steps should be taken:

a. Remove the victim immediately to fresh air. If breathing stops, begin artificial respiration at once. When breathing starts again, oxygen should be administered by qualified personnel.

b. Remove soaked clothing, and wash the skin with running water.

c. If the eyes are involved, wash them with running water for at least 15 minutes.

d. Secure medical attention immediately, making known to the medical personnel that the exposure is 1,1,1-trichloroethane.

Maximum Allowable Concentrations

32. Concentrations ranging up to 1,000 ppm can be tolerated *occasionally* for *short periods* of time up to 30 minutes.

33. The industrial hygiene standard for repeated eight-hour exposures has been set at 500 ppm.*

34. There are instruments on the market which can be used to analyze atmospheres containing 1,1,1-trichloroethane.**

Odor Levels

35. At 500 ppm, the odor is perceptible but not disagreeable to most persons.

36. At 1,000 ppm, the odor is strong and unpleasant. An exposure of one-half hour causes no ill effects, but flushing of the face is noted.

37. At 2,000 ppm, the odor is distinctly disagreeable with anesthetic effects noted in about five minutes.

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*"Threshold Limit Values for 1956," *AMA Archives of Industrial Health*, August, 1956, American Medical Association, Chicago 10, Ill.

**_Encyclopedia of Instrumentation for Industrial Hygiene_, 1956, University of Michigan Press, Ann Arbor, Michigan.

REFERENCES

Adams, Spencer, Rowe, and Irish, "Vapor Toxicity of 1,1,1-Trichloroethane (Methyl Chloroform) Determined by Experiments on Laboratory Animals," *AMA Archives of Industrial Hygiene and Occupational Medicine*, Vol. 1, p. 225, American Medical Association, Chicago 10, Illinois, 1950.

A.I.H.A. Hygienic Guide on 1,1,1-trichloroethane, American Industrial Hygiene Association, Detroit 27, Michigan, 1956.

Encyclopedia of Instrumentation for Industrial Hygiene, University of Michigan Press, Ann Arbor, Michigan, 1956.

"Threshold Limit Values for 1956," *AMA Archives of Industrial Health*, American Medical Association, Chicago 10, Illinois, August, 1956.

Von Oettingen, W. F., *The Halogenated Aliphatic, Olefinic, Cyclic, Aromatic and Aliphatic-Aromatic Hydrocarbons*, Public Health Service Publication No. 414, pp. 156, 157, U. S. Government Printing Office, Washington, D. C., 1955.

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