

loroethane

4: 293-9 (1985)
2.8-1 to I.12.8-4 EPA-600/2-82-001a (1982)
Chlorinated Hydrocarbon Manufacture

Criteria for Chlorinated Ethane p. C5-C13

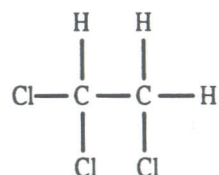
Environ 17: 611-7 (1983)
1: 385-93 (1987)
290-307 (1987)
Environ 24:225-33 (1983)

1,1,2-Trichloroethane

SUBSTANCE IDENTIFICATION

Synonyms:

Structure:



CAS Registry Number: 79-00-5

Molecular Formula: $\text{C}_2\text{H}_3\text{Cl}_3$

Wiswesser Line Notation: GYG1G

CHEMICAL AND PHYSICAL PROPERTIES

Boiling Point: 113.8 °C at 760 mm Hg

Melting Point: -36.5 °C

Molecular Weight: 133.42

Dissociation Constants:

Log Octanol/Water Partition Coefficient: 2.07 (calculated) [12]

Water Solubility: 4420 mg/L at 20 °C [22]

Vapor Pressure: 30.3 mm Hg at 20 °C [22]

Henry's Law Constant: 1.2×10^{-3} atm-m³/mole at 20 °C [22]

ENVIRONMENTAL FATE/EXPOSURE POTENTIAL

Summary: 1,1,2-Trichloroethane will enter the atmosphere from its use in the manufacture of vinylidene chloride and its use as a solvent. It will also be discharged in wastewater associated with these uses.

1,1,2-Trichloroethane

Releases to water will primarily be lost through evaporation (half-life days to weeks). Once in the atmosphere, 1,1,2-trichloroethane will photodegrade by reaction with hydroxyl radicals (half-life 24 days in unpolluted atmospheres to a few days in polluted atmospheres). 1,1,2-Trichloroethane has a low soil partition coefficient and as such will not partition into sediment and will readily pass through soil into the ground water where biodegradation is unlikely to occur. Bioconcentration is not a significant process. Primary human exposure is from occupational exposure and from ambient air in the vicinity of industrial sources and contaminated drinking water.

Natural Sources: None [32]

Artificial Sources: Emissions from its use as an intermediate in vinylidene chloride synthesis and as a solvent for chlorinated rubber, fats, oils, resins, and adhesives [16,39].

Terrestrial Fate: When released to land 1,1,2-trichloroethane should partially volatilize and partially leach into the ground water. It is unlikely that biodegradation will be an important process.

Aquatic Fate: When released into water, 1,1,2-trichloroethane should primarily volatilize into the atmosphere with a half-life of days to weeks. Little of the chemical will be lost by adsorption to sediment or by biodegradation.

Atmospheric Fate: When released into the atmosphere, 1,1,2-trichloroethane should degrade by reaction with hydroxyl radicals with a half-life of 24 days. The half-life in polluted atmospheres is much shorter, being of the order of 16 hr. A relatively water-soluble chemical such as 1,1,2-trichloroethane will be expected to partially washout in rain.

Biodegradation: 1,1,2-Trichloroethane showed no biodegradation in both a 24-day modified shake flask test and a river die-away test [23]. Similar results were obtained in another screening biodegradability test [18]. When a solution containing 1,1,2-trichloroethane was applied to a column filled with sandy soil, no loss could be attributed to biodegradation [42]. One investigation reported very slow biodegradation with long acclimation [36]. Vinyl chloride was observed to be a biodegradation product of 1,1,2-trichloroethane when microbes from an anaerobic digester at a municipal wastewater treatment facility

1,1,2-Trichloroethane

were used as inocula [11]. No significant degradation occurred over a 16-week incubation period in either sterilized or non-sterile subsurface (5 m deep) soil samples [41].

Abiotic Degradation: 1,1,2-Trichloroethane will react with photochemically produced hydroxyl radicals in the troposphere and degrade with a half-life of 24 days or a 2.8% loss per 12 hr sunlit day [31]. Its reaction under simulated smog conditions is much faster, the half-life being 16 hr [7]. Hydrolysis is expected to be slow, one experiment reporting no significant decrease in aqueous concentration in 8 days [3,17] and less than a 5% decrease in concentration in seawater in a closed system in darkness or daylight [17]. The half-life for the neutral aqueous hydrolysis of 1,1,2-trichloroethane at 25 °C has been estimated to be in excess of 50 years [21].

Bioconcentration: 1,1,2-Trichloroethane would not be expected to bioconcentrate in fish having a log bioconcentration factor of <1 [18].

Soil Adsorption/Mobility: There is little information on the measured adsorption of 1,1,2-trichloroethane to soil. The chemical moved readily through a column of sandy soil having a retardation factor (velocity of water through the soil divided by the velocity of pollutant) of <1.5, and the Koc is about 70 [42]. The log Kom (Koc = 1.724 Kom) of 1,1,2-trichloroethane has been estimated to range from 1.06-2.49 based on its log Kow value and five published prediction equations [30].

Volatilization from Water/Soil: Laboratory measurements of the rate of evaporation of 1,1,2-trichloroethane from water gave a half-life of 21 minutes [6]. In natural waters, half-lives would be expected to be of the order of days to weeks. Based upon field monitoring data, the half-life of 1,1,2-trichloroethane in a section of the Rhine river was 1.9 days which is probably the result of evaporative loss [43]. Due to its moderate vapor pressure, volatilization from soil will occur.

Water Concentrations: DRINKING WATER: Analysis of 945 finished water supplies nationwide (USEPA Ground Water Supply Survey) that use ground water sources did not detect any 1,1,2-trichloroethane at a quantification limit of 0.5 ppb [40]. 1,1,2-Trichloroethane has been detected in drinking water from samples of US cities [16,19,37] with 0.1-8.5 ppb being measured in the finished water from one metropolitan supply [37]. 20 ppb reported in a contaminated New York State well [2,4]; 30 Canadian water treatment facilities, 2 positive, 7 ppb max in

Aug/Sept; not detected in Nov/Dec [25]. **SURFACE WATER:** 1,1,2-Trichloroethane was detected in 2.0% of 1047 USEPA STORET water stations at a median concn below 5.0 ppb [35]. Not detected in raw water from 30 Canadian treatment facilities [25]. Detected, not qualified, River Glatt, Switzerland [44] 53 to 603 samples pos in representative New Jersey surface waters, max 18.7 ppb [27]; 2 tributaries on Ohio River, 3 of 7 samples pos, 0.6 ppb max, not found in 88 additional stations [24], Ohio River mainstream 0.4% of 246 samples pos, <1.0 ppb avg [8,24]. Not detected in Schuylkill River at Philadelphia, PA, DL = 0.01 ppb [8]. **GROUND WATER:** 1,1,2-Trichloroethane was detected in 2 of 13 ground water samples (associated with leaching from waste sites) from Minnesota at levels of 7.7 and 31 ppb [29]. Detected in 72 of 1069 samples in New Jersey, max 31.1 ppb, some of the most polluted being under urban land use areas [9,27]. **SEA WATER:** Shorewater concn of 1,1,2-trichloroethane off Point Reyes, CA 153 ppt [32].

Effluent Concentrations: Industries whose mean wastewater effluent exceeds 500 ppb are auto and other laundries and paint and ink formulations, max observed effluent concn is 3 ppm (auto and other laundries) [38] 5.4 ppm detected in industrial effluent discharge [16]. 1,1,2-Trichloroethane was detected in 2.8% of 1345 USEPA STORET effluent stations at a median concn below 2.0 ppb [35]. Positive identification was made for 1 of 13 effluent samples collected from a community septic tank serving 97 homes near Tacoma, WA [5].

Sediment/Soil Concentrations: 1,1,2-Trichloroethane has been qualitatively detected in the sediment/soil/water matrix of the Love Canal waste site near Niagara, NY [15].

Atmospheric Concentrations: URBAN/SUBURBAN: US (930 samples) 9.1 ppt median, 11,000 ppt max [1]. 1,1,2-Trichloroethane has been detected in New Jersey cities - 0.01-0.037 ppb avg but is not very prevalent (9 of 263 samples pos in one study) [13,14,20] 10 major US cities - 6-41 ppt avg [31,33]. Avg background concn at 2 California sites near San Francisco - inland site 14.6 ppt, 95% of 115 samples >6 ppt; nearshore site - 14.1 ppt, 48% of 225 samples >6 ppt [32]. **SOURCE RELATED:** US (97 samples) 45 ppt median, 25% of samples exceed 210 ppt, 2300 ppt max [1]; 2 of 5 industrial sites in US positive, trace to 1.06 ppb [28]; **RURAL/REMOTE:** US - not detected [1,10].

Food Survey Values:

Plant Concentrations:

Fish/Seafood Concentrations:

Animal Concentrations:

Milk Concentrations:

Other Environmental Concentrations:

Probable Routes of Human Exposure: Humans are exposed to 1,1,2-trichloroethane from ambient air, particularly near sources of emission and from contaminated drinking water supplies.

Average Daily Intake: AIR INTAKE: (assume 9.1 ppt) 1.0 ug; WATER INTAKE: (assume 0 ppb) 0 ug; FOOD INTAKE: insufficient data.

Occupational Exposures: Office air contained 5.7 ppm [26]. It is estimated that 112,000 workers are exposed to 1,1,2-trichloroethane [37].

Body Burdens: 1,1,2-Trichloroethane was not detected in any human adipose sample analyzed as part of the USEPA National Human Adipose Tissue Survey for fiscal year 1982 [34].

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