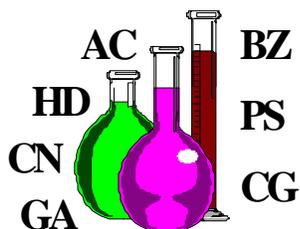


U.S. Army Center for Health Promotion and Preventive Medicine



Detailed Facts About Blood Agent Hydrogen Cyanide

(AC)

218-07-1096

Physical Properties of Hydrogen Cyanide

<i>Chemical Structure</i>	H-CN
<i>Chemical Formula</i>	HCN
<i>Description</i>	Pure AC is a nonpersistent, colorless liquid that is highly volatile. It has a faint odor similar to bitter almonds that sometimes cannot be detected even at lethal concentrations.
<i>Molecular Weight</i>	27.03
<i>Vapor Pressure (mm Hg)</i>	742 @ 25°C
<i>Boiling Point</i>	25.7°C
<i>Freezing Point</i>	-13.4°C
<i>Density</i>	Liquid = 0.7 Vapor = 0.94 (air = 1)
<i>Solubility</i>	Highly soluble and stable in water and alcohol; soluble in ether, glycerine, chloroform, and benzene.
<i>Flash Point</i>	-18°C
<i>Volatility</i>	37,000 mg/m ³ @ -40°C 1,080,000 mg/m ³ @ 25°C

Toxicity Values

LC ₅₀ (inhalation, 0.5 min)	= 2,000 mg-min/m ³
LC ₅₀ (inhalation, 30 min)	= 20,600 mg-min/m ³
LD ₅₀ (skin)	= 100 mg/kg (liquid)
NOAEL (inhalation)	= 670 mg-min/m ³
RfD (ingestion)	= 0.750 mg/l (liquid)

Exposure Limits

Workplace Time-Weighted Average -	11.0 mg/m ³
General Population Limits -	No standard identified

Toxic Properties of AC

Hydrogen cyanide is a fast acting, highly poisonous material. It may be fatal if inhaled, swallowed, or absorbed through the skin. It is an extremely hazardous liquid and vapor under pressure. With prompt treatment following overexposure, recovery is normally quick and complete. AC inactivates the enzyme cytochrome oxidase, preventing the utilization of oxygen by the cells.

Overexposure Effects

AC poisoning causes a deceptively healthy pink to red skin color. However, if physical injury or lack of oxygen is involved, the skin color may be bluish. Human health effects of overexposure by inhalation, ingestion, or skin contact may include nonspecific symptoms such as reddening of the eyes, flushing of the skin, nausea, headaches, dizziness, rapid respiration, vomiting, drowsiness, drop in blood pressure, rapid pulse, weakness, and loss of consciousness; central nervous system stimulation followed by central nervous system depression, hypoxic convulsions, and death due to respiratory arrest; temporary alteration of the heart's electrical activity with irregular pulse, palpitations, and inadequate circulation. Higher AC inhalation exposures may lead to fatality. In a few cases, disturbances of vision or damage to the optic nerve or retina have been reported, but the exposures have been acute and at lethal or near-lethal concentrations. Skin permeation can occur in amounts capable of producing systemic toxicity. There are no reports of human sensitization.

Emergency and First Aid Procedures

Inhalation: remove patient to fresh air, and lay patient down; administer oxygen and amyl nitrite; keep patient quiet and warm; even with inhalation poisoning, thoroughly check clothing and skin to assure no cyanide is present; seek medical attention immediately.

Eye Contact: flush eyes immediately with plenty of water; remove contaminated clothing; keep patient quiet and warm; seek medical attention immediately.

Skin Contact: wash skin promptly to remove the cyanide while removing all contaminated clothing, including shoes; do not delay; skin absorption can occur from cyanide dust, solutions, or HCN vapor; absorption is slower than inhalation, usually measured in minutes compared to seconds; HCN is absorbed much faster than metal cyanides from solutions such as sodium,

potassium or copper cyanide solutions; even after washing the skin, watch the patient for at least 1 to 2 hours because absorbed cyanide can continue to work into the bloodstream; wash clothing before reuse and destroy contaminated shoes.

Ingestion: give patient one pint of 1 percent sodium thiosulfate solution (or plain water) immediately by mouth and induce vomiting; repeat until vomit fluid is clear; never give anything by mouth to an unconscious person; give oxygen; seek medical attention immediately.

Protective Equipment

Protective Gloves: Wear Butyl or Neoprene rubber gloves.

Eye Protection: Wear chemical splash goggles as a minimum.

Other: Have available and use as appropriate - rubber suits and gloves; full-body chemical suit; self-contained breathing air supply; HCN detector; First Aid and Medical Treatment supplies, including oxygen resuscitators.

Reactivity Data

Stability: Unstable with heat, alkaline materials, and water. Do not store wet HCN; may react violently with strong mineral acids; experience shows mixtures with about 20 percent or more sulfuric acid will explode; effects with other acids are not quantified, but strong acids like hydrochloric or nitric would probably react similarly.

Decomposition: See Polymerization.

Polymerization: Can occur violently in the presence of heat, alkaline materials, or moisture. Once initiated, polymerization becomes uncontrollable since the reaction is autocatalytic, producing heat and alkalinity; confined polymerization can cause a violent explosion. HCN is stabilized with small amounts of acid to prevent polymerization; it should not be stored for extended periods unless routine.

Persistency Short; the agent is highly volatile, and in the gaseous state it dissipates quickly in the air.

References

1. Department of the Army Field Manual (DA FM) 3-9, *Potential Military/Biological Agents and Compounds*, 1990.

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3. U.S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study*, 15 September 1993.
4. Genium's Reference Collection, *Material Safety Data Sheets Collection: Sheet No. 686*, Genium Publishing Corporation, Schenectady, New York, 1989.

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