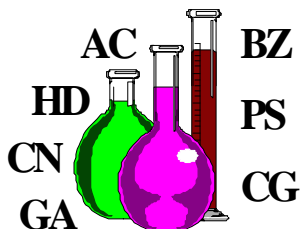


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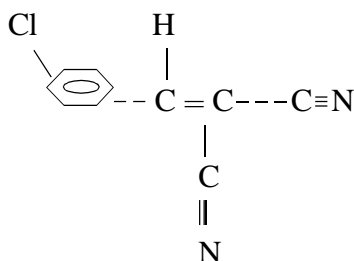


*Detailed Facts About Tear Agent
O-Chlorobenzylidene Malononitrile
(CS)*

218-23-1096

*Physical Properties of Tear Agent
O-Chlorobenzylidene Malononitrile*

Chemical Structure



Chemical Formula

$C_{10}H_5ClN_2$

Description

CS is a white crystalline solid; burnt to create a colorless gas with an acrid pepperlike smell.

Molecular Weight

188.5

Boiling Point

310°C to 315°C

Vapor Pressure (mm Hg)

3.4×10^{-5} @ 20°C

Freezing Point

93°C to 95°C

Density

Solid = 1.04 g/cc
Vapor - several times heavier than air

Solubility

Soluble in hexane, benzene, methylene chloride, acetone, dioxane, ethyl acetate, and pyridine; insoluble in water and ethanol.

Flash Point

197°C

Volatility 0.71 mg/m³ @ 25°C

Toxicity Values
ICt₅₀ = 10 to 20 mg-min/m³
LCt₅₀ = 61,000 mg-min/m³

Exposure Limits

Workplace Time-Weighted Average - 0.4 mg/m³
General Population Limits - No standard identified

Toxic Properties of O-Chlorobenzylidene Malononitrile

CS was developed in the late 1950s as a riot-control substance. It is a more potent irritant than chloroacetophenone but less incapacitating. In the late 1960s, stocks of CS replaced CN. Presently, the U.S. Army uses CS for combat training and riot control purposes.

Overexposure Effects

CS is disseminated by burning, explosion, and aerosol formation. It is immediately irritating to the eyes and upper respiratory tract. Warm vapors mix with human sweat to cause a burning sensation to the eyes, nose, and mouth. Conjunctivitis and pain in the eyes, lacrimation, erythema of the eyelids, runny nose, burning throat, coughing and constricted feeling in the chest are the effects which will occur immediately and will persist 5 to 20 minutes after removal from the contaminated area.

It is immediately dangerous to life and health at a concentration of 2 mg/m³. It is not an accumulative agent in the human body, although it accumulates in the landscape. CS is the most persistent of the tear agents, absorbing into the most porous surfaces including soil and plaster.

Emergency and First Aid Procedures

Inhalation: remove the victim to fresh air immediately; perform artificial respiration if breathing has stopped; keep the victim warm and at rest; seek medical attention immediately.

Eye Contact: wash eyes immediately with copious amounts of water for at least 15 minutes; apply an ophthalmic corticosteroid ointment after decontamination; treat delayed erythema with a bland shake lotion (such as calamine lotion) or a topical corticosteroid depending on severity; do not wear contact lenses when working with this chemical; seek medical attention immediately.

Skin Contact: wash the contaminated skin thoroughly using soap and water; remove the contaminated clothing immediately; if irritation persists after washing, seek medical attention immediately.

Ingestion: give victim copious amounts of water immediately; induce vomiting by having victim touch the back of throat with finger; do not make an unconscious person vomit; seek medical attention immediately.

Protective Equipment

Protective Gloves:	Wear impervious gloves; rubber gloves.
Eye Protection:	Wear face shields or dust- and splash-proof safety goggles to prevent any possibility of skin contact.
Other:	Wear protective mask and overclothing in confined spaces; use a chemical cartridge respirator with organic vapor cartridges in combination with a high efficiency particulate filter; wear a self-contained breathing apparatus with a full face piece or an air purifying, full-face piece respirator with an organic vapor canister.

Do not use standard decontaminants or detergents that contain chlorine bleach because the materials can react to form compounds more toxic than CS. Contaminated surfaces should be decontaminated using a solution of equal parts (by volume) methanol and water with 18 percent (by weight) sodium hydroxide or commercial lye added to the solution. Also, an aqueous solution containing 10 percent monoethanolamine anionic detergent can be used as a decontaminant.

Reactivity Data

Stability:	Stable in storage.
Incompatibility:	Incompatible with strong oxidizers.
Hazardous Decomposition:	When heated to decomposition, CS emits very toxic fumes.
Hydrolysis Products:	AQ Alkaline.

Persistency Varies, depending upon amount of contamination.

References

1. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.
2. *The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Eleventh Edition*, Merck & Co., Inc., Rahway, New Jersey, 1989
3. *Hazardous Substances Data Bank*, January 1996.

For more information, contact:
Kenneth E. Williams
USACHPPM
Aberdeen Proving Ground, MD 21010-5422
Commercial (410) 671-2208, DSN: 584-2208
email: kwilliam@aeha1.apgea.army.mil