SIGMA-ALDRICH

Material Safety Data Sheet

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Section 1 - Product and Company Information

Product Name Acetaldehyde, ≥99.5%, A.C.S. reagent
Product Number 402788
Brand Sigma-Aldrich

Company Sigma-Aldrich
Street Address 3050 Spruce Street
City, State, Zip, Country SAINT LOUIS, MO 63103 US
Technical Phone: 800-325-5832 **Emergency Phone:** 314-776-6555
Fax: 800-325-5052

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313	EC no	Annex I Index Number
ACETALDEHYDE	75-07-0	Yes	200-836-8	605-003-00-6

Formula C2H4O
Synonyms Acetaldehyd (German), Acetaldehyde (ACGIH:OSHA), Acetic aldehyde, Acetylaldehyde, Aldehyde acetique (French), Aldeide acetica (Italian), Ethanal, NCI-C56326, Octowy aldehyd (Polish), RCRA waste number U001

Section 3 - Hazards Identification

Emergency Overview
Flammable (USA) Extremely Flammable (EU). Harmful.
Harmful if swallowed. Irritating to eyes and respiratory system. Risk of serious damage to eyes. May cause sensitization by skin contact. Limited evidence of a carcinogenic effect.
Possible Carcinogen (US). Photosensitizer. Lachrymator. Target organ(s): Blood. Kidneys. Calif. Prop. 65 carcinogen.

HMIS Rating
Health: 2* Flammability: 4 Reactivity: 2

NFPA Rating
Health: 2 Flammability: 4 Reactivity: 2

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

Oral Exposure
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

Inhalation Exposure
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

Dermal Exposure
In case of contact, immediately wash skin with soap and copious amounts of water.

Eye Exposure
In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

Flammable Hazards: Yes **Peroxide Former:** Yes

Explosion Hazards
May explode when heated.
Closed containers may rupture and explode during runaway polymerization.
Vapors may form explosive mixtures with air.

Flash Point: -40 °F -40 °C

Explosion Limits: **Lower:** 4 % **Upper:** 60 %

Autoignition Temp: 175 °C **Flammability:** Yes

Extinguishing Media
Suitable
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Firefighting
Protective Equipment
Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s)
Extremely flammable. Emits toxic fumes under fire conditions. Vapor may travel considerable distance to source of ignition and flash back.
Specific Method(s) of Fire Fighting
Use water spray to cool fire-exposed containers.

Section 6 - Accidental Release Measures

Procedure to be Followed in Case of Leak or Spill
Evacuate area. Shut off all sources of ignition. Use nonsparking tools.

Procedure(s) of Personal Precaution(s)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

Methods for Cleaning Up
Cover with an activated carbon adsorbent, take up and place in closed containers. Transport outdoors.

Section 7 - Handling and Storage

Handling
User Exposure
Do not breathe vapor. Do not get in eyes, on skin, on clothing. Open carefully. Avoid all contamination. Always open containers slowly to allow any excess pressure to vent.

Storage
Suitable
Keep container closed. Keep away from heat, sparks, and open flame. Store under nitrogen. Store at 2-8°C

Special Requirements
Store under inert gas. May develop pressure. Air sensitive.

Section 8 - Exposure Controls / PPE

Engineering Controls
Safety shower and eye bath. Use nonsparking tools. Mechanical exhaust required.

Personal Protective Equipment
Respiratory
Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand
Compatible chemical-resistant gloves.
Eye
Chemical safety goggles.

General Hygiene Measures
Remove and wash contaminated clothing promptly. Wash thoroughly after handling.

Exposure Limits

Country	Type	Value
Poland	NDS	5 MG/M3
Poland	NDSCh	-
Poland	NDSP	45

Exposure Limits, RTECS

Country	Source	Type	Value
USA	ACGIH	Ceiling concentration	25 PPM
USA	MSHA Standard-air	TWA	100 PPM (180 MG/M3)
USA	OSHA.	PEL	8H TWA 200 PPM (360 MG/M3)
New Zealand	OEL		
Remarks: check ACGIH TLV			
USA	NIOSH		(18 PPM LOQ)

Section 9 - Physical/Chemical Properties

Appearance

Physical State	Color
Clear liquid	Colorless

Molecular Weight: 44.05 AMU

Property	Value	At Temperature or Pressure
pH	N/A	
BP/BP Range	21 °C	760 mmHg
MP/MP Range	-125 °C	
Freezing Point	N/A	
Vapor Pressure	756.4 mmHg	20 °C
Vapor Density	1.52 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	0.785 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	< 1 Pas	20 °C
Partition Coefficient	Log Kow: 0.5	
Decomposition Temp.	N/A	
Flash Point °F	-40 °F	Method: closed cup
Flash Point °C	-40 °C	Method: closed cup
Explosion Limits	Lower: 4 % 4 % Upper: 60 % 57 %	
Flammability	N/A	
Autoignition Temp	175 °C	
Refractive Index	1.3320	20 °C

Solubility
Solubility in Water: Miscible.

N/A = not available

Section 10 - Stability and Reactivity

Stability
Stable
Unstable.
Conditions to Avoid
Air.
Materials to Avoid
Oxidizing agents, Reducing agents, Acids, Nitric acid, Peroxides, Bases, Caustic soda, Amines, Ammonia, Oxygen, Warning: acelaldehyde is oxidized rapidly and exothermically by air, to acetic acid, Acid anhydrides, Alcohols, Halogens, Ketones, Phenol, Hydrogen cyanide.

Hazardous Decomposition Products
Hazardous Decomposition Products
Carbon monoxide, Carbon dioxide.

Hazardous Polymerization
Hazardous Polymerization
Oxidized readily in air to form unstable peroxides that can lead to spontaneous explosion., May undergo autopolymerization, Uncontrolled polymerization can cause rapid evolution of heat and increased pressure which can result in violent rupture of storage vessels or containers..

Section 11 - Toxicological Information

Route of Exposure
Skin Contact
May cause skin irritation.
Skin Absorption
May be harmful if absorbed through the skin.
Eye Contact
Causes severe eye irritation. Lachrymator.
Inhalation
May be harmful if inhaled. Material is irritating to mucous membranes and upper respiratory tract.
Ingestion
Harmful if swallowed.

Sensitization
Sensitization
Sensitizer.

Skin
The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.
May cause allergic skin reaction.

Target Organ(s) or System(s)
Blood. Kidneys. Lungs. Cardiovascular system. Liver. Central nervous system.

Signs and Symptoms of Exposure
Exposure can cause: Pulmonary edema. Effects may be delayed. Nausea. Vomiting. Headache. Blurred vision. Unconsciousness.

RTECS Number: AB1925000

Toxicity Data

Oral - Rat: 661 mg/kg (LD50)
Remarks: Peripheral Nerve and Sensation:Spastic paralysis with or without sensory change.
Behavioral:Altered sleep time (including change in righting reflex).
Lungs, Thorax, or Respiration:Dyspnea.

Inhalation - Rat: 13,300 ppm (LC50)
Remarks: Behavioral:Excitement.
Lungs, Thorax, or Respiration:Dyspnea.

Subcutaneous - Rat: 640 MG/KG (LD50)
Remarks: Behavioral:General anesthetic.

Oral - Mouse: 900 mg/kg (LD50)

Inhalation - Mouse: 23,000 mg/m3 (LC50)

Intraperitoneal - Mouse: 500 MG/KG (LD50)

Subcutaneous - Mouse: 560 MG/KG (LD50)
Remarks: Behavioral:General anesthetic.

Skin - Rabbit: 3540 mg/kg (LD50)

Inhalation - Hamster: 17,000 ppm (LC50)

Intratracheal - Hamster: 96 MG/KG (LD50)

Inhalation - Mammal: 20,100 mg/m3 (LC50)
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Other.
Behavioral:Excitement.
Lungs, Thorax, or Respiration:Dyspnea.

Irritation Data

Skin - Rabbit: 500 mg
Remarks: Mild irritation effect

Eyes - Human: 50 ppm 15M

Skin - Rabbit: 500 mg
Remarks: Open irritation test

Eyes - Rabbit: 40 mg
Remarks: Severe irritation effect

Chronic Exposure - Carcinogen
Result: This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Rat - Inhalation: 735 PPM 6H/2Y I
Result: Tumorigenic:Carcinogenic by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Olfaction:Tumors.

Hamster - Inhalation: 2040 PPM 7H/52W I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Olfaction:Tumors. Lungs, Thorax, or Respiration:Tumors.

Rat - Inhalation: 1410 PPM 6H/65W I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Olfaction:Tumors.

IARC Carcinogen List
Rating
Group 2B

NTP Carcinogen List
Rating
Anticipated to be a carcinogen.

ACGIH Carcinogen List
Rating
A3

Chronic Exposure - Teratogen

Species	*Dose*	*Route of Application*	*Exposure Time*
	Result:Laboratory experiments have shown teratogenic effects.		
Rat	4800 MG/KG	Oral	(1-20D PREG)
	Result:Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Respiratory system. Specific Developmental Abnormalities: Hepatobiliary system.		
Rat	5040 MG/KG	Oral	(1-21D PREG)
	Result:Specific Developmental Abnormalities: Central nervous system. Specific Developmental Abnormalities: Endocrine system. Specific Developmental Abnormalities: Urogenital system.		
Rat	100 MG/KG	Intraperitoneal	(12D PREG)
	Result:Specific Developmental Abnormalities: Homeostasis		
Rat	400 MG/KG	Intraperitoneal	(8-15D PREG)
	Result:Specific Developmental Abnormalities: Eye, ear. Specific Developmental Abnormalities: Musculoskeletal system.		
Rat	600 MG/KG	Intraperitoneal	(8-15D PREG)
	Result:Specific Developmental Abnormalities: Craniofacial (including nose and tongue).		
Mouse	640 UG/KG	Intraperitoneal	(10D PREG)
	Result:Specific Developmental Abnormalities: Musculoskeletal system.		

Chronic Exposure - Mutagen

Species	*Dose*	*Cell Type*	*Mutation test*
	Result: Laboratory experiments have shown mutagenic effects.		

Human	1560 UMOL/L			lymphocyte	DNA damage
Human	3 MMOL/L			Other cell types	DNA damage
Human	30 MMOL/L			Other cell types	DNA inhibition
Human	30 MMOL/L			Other cell types	Other mutation test systems
Human	10 MMOL/L			HeLa cell	DNA inhibition
Human	1000 PPM		72H	leukocyte	Cytogenetic analysis
Human	1200 UMOL/L			lymphocyte	Sister chromatid exchange
Human	40 UMOL/L			fibroblast	Sister chromatid exchange
Human	5 MMOL/L			fibroblast	Mutation in mammalian somatic cells.
Rat	500 UMOL/L			fibroblast	Micronucleus test
Rat	3 MMOL/L		3H	kidney	Morphological transformation.
Rat	100 UMOL/L			fibroblast	Morphological transformation.
Rat	200 MMOL/L			liver	DNA damage
Rat	1000 PPM	Inhalation	6H/5D		DNA damage
Rat	500 MMOL/L			Other cell types	DNA damage
Rat	12500 UMOL/L			Other cell types	Other mutation test systems
Rat	1 MMOL/L			fibroblast	DNA inhibition
Rat	1 MMOL/L			fibroblast	Other mutation test systems
Rat	100 UMOL/L			fibroblast	Cytogenetic analysis
Mouse	95 MG/KG	Intraperitoneal			Micronucleus test
Mouse	10 MG/L			Embryo	Morphological transformation.
Mouse	15 NG/KG	Intraperitoneal			Sister chromatid exchange
Mouse	4 MMOL/L			lymphocyte	Mutation in mammalian somatic cells.
Hamster	40 PPM			Embryo	Cytogenetic analysis
Hamster	500 UG/KG	Intraperitoneal			Sister chromatid exchange
Hamster	30 UMOL/L			ovary	Sister chromatid exchange
Hamster	20 PPM			Embryo	SLN
Mammal	1 MOL/L		30M	lymphocyte	DNA damage

Chronic Exposure - Reproductive Hazard

Species	*Dose*	*Route of Application*	*Exposure Time*
Rat	5040 MG/KG	Oral	(1-21D PREG)

Result: Effects on Newborn: Growth statistics (e.g., reduced weight gain).

Rat	300 MG/KG	Intraperitoneal	(8-13D PREG)

Result: Effects on Newborn: Behavioral.

Rat	50 MG/KG	Intraperitoneal	(12D PREG)

Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Mouse	120 MG/KG	Intravenous	(7-9D PREG)

Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Mouse	4 GM/KG	Intravenous	(6D PREG)

Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Specific Developmental Abnormalities: Central nervous system.

Section 12 - Ecological Information

Acute Ecotoxicity Tests

Test Type
EC50 Algae

Time:	**Value:**
24.0 h	270 mg/l

Test Type
EC50 Daphnia
Species
Daphnia magna

Time:	**Value:**
48.0 h	48 mg/l

Test Type
LC50 Fish
Species
Pimephales promelas (Fathead minnow)

Time:	**Value:**
96.0 h	31 mg/l

Test Type
LC50 Fish
Species
Lepomis macrochirus (Bluegill)

Time:	**Value:**
96.0 h	53 mg/l

Test Type
LC100 Fish
Species
Leuciscus idus

Time:	**Value:**
48.0 h	124 - 156 mg/l

Section 13 - Disposal Considerations

Appropriate Method of Disposal of Substance or Preparation
Contact a licensed professional waste disposal service to dispose of this material.
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable.
Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Acetaldehyde
UN#: 1089
Class: 3
Packing Group: Packing Group I
Hazard Label: Flammable liquid
PIH: Not PIH

IATA
Proper Shipping Name: Acetaldehyde
IATA UN Number: 1089
Hazard Class: 3
Packing Group: I
Not Allowed - Aircraft: Cargo aircraft only. Not permitted on passenger aircraft.

Section 15 - Regulatory Information

EU Directives Classification
Symbol of Danger: F+ Xn
Indication of Danger
Extremely Flammable. Harmful.
Risk Statements **R:** 12 36/37 40
Extremely flammable. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect.
Safety Statements **S:** 16 33 36/37
Keep away from sources of ignition - no smoking. Take precautionary measures against static discharges. Wear suitable protective clothing and gloves.

US Classification and Label Text
Indication of Danger
Flammable (USA) Extremely Flammable (EU). Harmful.
Risk Statements
Harmful if swallowed. Irritating to eyes and respiratory system. Risk of serious damage to eyes. May cause sensitization by skin

contact. Limited evidence of a carcinogenic effect.

Safety Statements

Keep away from sources of ignition - no smoking. Take precautionary measures against static discharges. Wear suitable protective clothing and gloves.

US Statements

Possible Carcinogen (US). Photosensitizer. Lachrymator. Target organ(s): Blood. Kidneys. Calif. Prop. 65 carcinogen.

United States Regulatory Information

SARA Listed: Yes

Deminimis: 0.1 %

Notes: This product is subject to SARA section 313 reporting requirements.

TSCA Inventory Item: Yes

United States - State Regulatory Information

California Prop - 65

This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause cancer.

Canada Regulatory Information

WHMIS Classification

This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL: Yes

NDSL: No

Section 16 - Other Information

Disclaimer

For R&D use only. Not for drug, household or other uses.

Warranty

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.