

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 3134
SRM Name: Molybdenum (Mo) Standard Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of molybdenum. A unit of SRM 3134 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of molybdenum.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
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2. HAZARDS IDENTIFICATION

Classification

Physical Hazard: Not classified.
Health Hazard: Skin Corrosion/Irritation Category 1B
Serious Eye Damage/Eye Irritation Category 1

Label Elements Symbol



Signal Word
DANGER

Hazard Statement(s)

H314 Causes severe skin burns and eye damage.

Precautionary Statement(s)

P260 Do not breathe fume, mists, vapors, spray.
P264 Wash hands thoroughly after handling.
P280 Wear protective gloves, protective clothing, eye protection.
P301 + P330 + P331 If swallowed: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P304 + P340 If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a poison center or doctor.
P363 Wash contaminated clothing before reuse.
P390 Absorb spillage to prevent material damage.
P405 Store locked up.

P501

Dispose of contents according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Hydrochloric Acid/Molybdenum chloride Solution

Other Designations:

Hydrochloric Acid (no other designations listed)

Molybdenum chloride (molybdenum (V) chloride, molybdenum pentachloride).

NOTE: Molybdenum in hydrochloric acid solution forms a solvated molybdenum chloride salt.

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Hydrochloric Acid	7647-01-0	231-595-7	<20
Molybdenum Chloride	10241-05-1	233-575-3	2.8
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>77

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Use extinguishing media appropriate to the surrounding fire.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Thermal decomposition will form oxides of nitrogen.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, “Exposure Controls and Personal Protection”.

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, “Exposure Controls and Personal Protection”. Handle glass ampoules with care.

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal oxides, reducing agents, peroxides, metal carbide, cyanides).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Component: Hydrochloric Acid

NIOSH (REL): 7 mg/m³; 5 ppm (Ceiling)
50 ppm (IDLH)

ACGIH (TLV): 2 ppm (Ceiling)

OSHA (PEL): 7 mg/m³; 5 ppm (Ceiling)

Component: Molybdenum, soluble compounds

NIOSH (REL): 5 mg/m³; 2 ppm (TWA)

ACGIH (TLV): 10 mg/m³; 4 ppm (TWA) inhalable fraction; 3 mg/m³; 2 ppm (TWA) respirable fraction

OSHA (PEL): 5 mg/m³; 2 ppm (TWA); 15 mg/m³; 10 ppm (TWA) total dust

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties:

Appearance (physical state, color, etc.):	Not available
Molecular Formula:	Not applicable
Molar Mass (g/mol):	Not available
Odor:	Not available
Odor threshold:	Not available
pH:	acidic
Evaporation rate (ether = 1):	Not available
Melting point/freezing point (°C):	Not available
Relative Density (g/L):	Not available
Vapor Pressure (mmHg):	Not available
Vapor Density (air = 1):	Not available
Viscosity (cP):	Not available
Solubility(ies):	Not available
Partition coefficient (n-octanol/water):	Not available
Particle Size (if relevant)	Not applicable

Thermal Stability Properties:

Autoignition Temperature (°C):	Not applicable
Thermal Decomposition (°C):	Not applicable
Initial boiling point and boiling range (°C):	Not available
Explosive Limits, LEL (Volume %):	Not applicable
Explosive Limits, UEL (Volume %):	Not applicable
Flash Point (°C)	Not applicable
Flammability (solid, gas):	Not applicable

10. STABILITY AND REACTIVITY

Reactivity: Not reactive per SARA 311/312 and NFPA.

Stability: X Stable Unstable

Possible Hazardous Reactions: May react with evolution of heat; release toxic, corrosive, flammable or explosive gases on contact with water.

Conditions to Avoid: Heat, flames, sparks and other sources of ignition. May ignite or explode on contact with combustible materials.

Incompatible Materials: Acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal carbide, cyanides.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition will produce hydrogen chloride gas.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: Inhalation Skin Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain, severe skin corrosion, and eye damage.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Inhalation of hydrochloric acid can damage the mucous membranes and upper respiratory tract. Short term exposure may cause irritation and inflammation of the upper respiratory tract, coughing, choking, sore throat, shortness of breath, headache, dizziness, and nausea. Long term exposure to acid fumes may cause damage to teeth, bronchial irritation, chronic cough, bronchial pneumonia, and gastrointestinal disturbances. Acute exposure to molybdenum chloride may cause irritation of the mucous membranes. No data available for chronic exposure.

Skin Contact: Hydrochloric acid can cause severe skin burns. Severity of the damage depends on the concentration and duration of exposure. Effects of acid burns may be delayed. Molybdenum chloride may cause irritation.

Eye Contact: Hydrochloric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure. Acute exposure to molybdenum chloride may cause irritation; chronic exposure may result in conjunctivitis.

Ingestion: If ingested, concentrated hydrochloric acid can cause burns to the gastrointestinal tract. No data available for ingestion of molybdenum chloride.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.

Hydrochloric acid, Rat, Inhalation LC50: 1562 ppm (4 h)

Hydrochloric acid, Rat, Oral LD50: 700 mg/kg

Molybdenum chloride: No data available.

Skin Corrosion/Irritation: This SRM contains >1 % of hydrochloric acid and it is classified as Category 1B.

Serious Eye damage/ Eye irritation: This SRM contains >1 % hydrochloric acid and it is classified as Category 1.

Molybdenum chloride: No data available.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: Not classified.

Listed as a Carcinogen/Potential Carcinogen Yes No

Hydrochloric acid is not listed in NTP, IARC or OSHA as a carcinogen.

Molybdenum chloride is not listed in NTP, IARC or OSHA as a carcinogen.

Reproductive Toxicity: Not classified.

Hydrochloric acid, Rat, Oral TDLo: 450 mg/kg (1 hour prior to copulation)

Specific Target Organ Toxicity, Single Exposure: Not classified.

Specific Target Organ Toxicity, Repeated Exposure: Not classified.

Aspiration Hazard: No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Component: Hydrochloric Acid

Mosquitofish (*Gambusia affinis*), LC50: 282 mg/L, Static (96 h)

Shore crab (*Carcinus maenas*), LC50: 240 mg/L (48 h)

Component: Molybdenum chloride

No information available.

Persistence and Degradability: No data available.

Bioaccumulative Potential: No data available.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Hydrochloric acid subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Number: D002

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1760, Corrosive liquid, n.o.s. (contains hydrochloric acid), Hazard Class 8, Packing Group II, Excepted Quantities E2.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Hydrochloric Acid, 5000 lbs; 2270 kg RQ.

SARA Title III Section 302 (40 CFR 355.30): Hydrochloric Acid, 500 lbs TPQ (gas only).

SARA Title III Section 304 (40 CFR 355.40): Hydrochloric Acid, 5000 lbs EPCRA RQ (gas only).

SARA Title III Section 313 (40 CFR 372.65):

Hydrochloric Acid: 1 % de minimis concentration (acid aerosols including mists, vapors, gas, for, and other airborne forms of any particle size).

OSHA Process Safety (29 CFR 1910.119):

Regulated for Hydrochloric Acid at higher concentrations 500 lb TQ (anhydrous).

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes.
CHRONIC HEALTH:	No.
FIRE:	No.
REACTIVE:	No.
PRESSURE:	No.

State Regulations:

California Proposition 65: Not listed.

U.S. TSCA Inventory: Hydrochloric acid and molybdenum chloride are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 10 May 2024

Sources: ChemAdvisor, Inc., MSDS *Hydrochloric Acid 2N*, 09 December 2015.

ChemAdvisor, Inc., MSDS *Molybdenum Pentachloride*, 09 December 2015.

ChemAdvisor, Inc., MSDS *Molybdenum*, 13 March 2013.

PubChem, National Library of Medicine, *Hydrochloric Acid* CAS 7647-01-0, Animal Toxicity Studies, available at <https://pubchem.ncbi.nlm.nih.gov/compound/313> (accessed May 2024).

PubChem, National Library of Medicine, *Molybdenum chloride* CAS 10241-05-1, available at <https://pubchem.ncbi.nlm.nih.gov/compound/61497> (accessed May 2024).

NIOSH Pocket Guide to Chemical Hazards, *Molybdenum (soluble compounds, as Mo)*, available at <https://www.cdc.gov/niosh/npg/npgd0434.html> (accessed May 2024).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50%	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	WHMIS	Workplace Hazardous Materials Information System

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