

SAFETY DATA SHEET

Sodium molybdate crystalline

Section 1. Identification

Product name	: Sodium molybdate crystalline
Chemical name	: Na ₂ MoO ₄ ·2H ₂ O
CAS number	: 10102-40-6 7631-95-0 (for the anhydrous Na ₂ MoO ₄)
Synonyms	: sodium molybdate dihydrate, disodium molybdate dihydrate, sodium molybdate

Uses

Material uses

A micro-nutrient in manufacture and use of fertilizers; an animal feed micro-nutrient additive; corrosion inhibitor; pigment manufacture; industrial detergent for metal surface treatment; cleaning & maintenance material; as coolant/anti-freeze/heat transfer fluid; metal working fluids; industrial formulation & use of lubrication additives, lubricants and greases; enamel frit manufacture; ceramics; manufacture & use of water treatments chemicals, including water softener; polymer preparations & compounds; industrial chemical products such as pH regulator, flocculants, precipitants, neutralization agents; extraction agents; photochemicals; manufacture and use of catalysts, including regeneration & recycling.

Supplier's details	: Climax Molybdenum Company 333 N. Central Ave Phoenix AZ 85004 Phone: 602-366-8100
Emergency telephone number (with hours of operation)	: Carechem 24/7: +1 866 928 0789 (United States - Toll Free) +1 215 207 0061 (Americas) +1 202 464 2554 (United States and Canada)

Section 2. Hazards identification

Classification of the substance or mixture	: Not classified.
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GHS label elements

Signal word	: No signal word.
Hazard statements	: No known significant effects or critical hazards.
Precautionary statements	
Prevention	: Not applicable.
Response	: Not applicable.
Storage	: Not applicable.
Disposal	: Not applicable.
Hazards not otherwise classified	: None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Ingredient name	%	CAS number
Sodium molybdate crystalline	>99%	10102-40-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

- Eye contact** : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.
- Inhalation** : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.
- Skin contact** : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.
- Ingestion** : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** : No known significant effects or critical hazards.
- Inhalation** : No known significant effects or critical hazards.
- Skin contact** : No known significant effects or critical hazards.
- Ingestion** : No known significant effects or critical hazards.

Indication of immediate medical attention and special treatment needed, if necessary

- Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** : No specific treatment.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

- Hazardous thermal decomposition products** : Decomposition products may include the following materials:
metal oxide/oxides

Section 5. Fire-fighting measures

- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
- Special protective equipment for fire-fighters** : As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH (approved or equivalent) and full protective gear.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.
- For emergency responders** : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

- Small spill** : Move containers from spill area. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.
- Large spill** : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8).
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Implement means to control the spread of contaminated material. If necessary workers should remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Sodium molybdate crystalline	ACGIH TLV (United States, 1/2022). [Molybdenum, soluble compounds as Mo] TWA: 0.5 mg/m ³ , (as Mo) 8 hours. Form: Respirable fraction OSHA PEL (United States, 5/2018). [Molybdenum Soluble compounds (as Mo)] TWA: 5 mg/m ³ , (as Mo) 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls

: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls

: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection

: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

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.

Other skin protection

: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection

: Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

Appearance

Physical state

: Solid.

Vapor pressure

: Considered negligible at standard temperature.

Color

: colorless to white

Vapor density

: Not applicable.

Odor

: Odorless.

Relative density

: 3.28 at 4 °C.

Not available.

Section 9. Physical and chemical properties

Odor threshold	:		Solubility	:	654 g/L in water at 20°C
pH	:	The pH of a saturated solution of sodium molybdate dihydrate in water (654 g/L) at 20°C is 8.8.	Solubility in water	:	654 g/L in water at 20°C.
Melting point	:	687°C for the anhydrous form.	Partition coefficient: n-octanol/water	:	
Boiling point	:	Not available.	Auto-ignition temperature	:	Not applicable.
Flash point	:	Not applicable.	Decomposition temperature	:	Sodium molybdate dihydrate decomposes at ca. 100°C.
Evaporation rate	:	Not available.	Viscosity	:	Not applicable.
Flammability (solid, gas)	:	Not flammable.	Flow time (ISO 2431)	:	Not available.
Lower and upper explosive (flammable) limits	:	Not applicable.			

Section 10. Stability and reactivity

Reactivity	:	Stable under ambient temperatures and pressures.
Chemical stability	:	Stable under ambient temperatures and pressures.
Possibility of hazardous reactions	:	According to "Bretherick's Handbook" molybdates react violently or explosively when reduced to molybdenum by heating with zirconium. Furthermore, in the preparation of dyestuffs from aniline, nitrobenzene (as oxidant), hydrochloric acid and sodium hydroxide, ferric chloride is often used as catalyst, but sodium molybdate was substituted as a more effective catalyst. The materials were charged into a 4.5 m3 reactor and heating was started after addition of nitrobenzene, but the temperature controller was mis-set, and overheating at a high rate ensued. The exothermic reaction was much higher than normal because of the more effective catalyst, and partial failure of the cooling water led to an uncontrollable exothermic reaction. Other hazardous reactions have not been identified.
Conditions to avoid	:	No specific conditions to avoid have been identified.
Incompatible materials	:	Incompatible materials: alkali metals, interhalogens (due to the water of hydration in sodium molybdate dihydrate; not applicable to anhydrous sodium molybdate).
Hazardous decomposition products	:	No hazardous decomposition products have been identified.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
disodium molybdate	LC50 Inhalation Vapor LD50 Dermal LD50 Oral	Rat Rat Rat - Male, Female	>1.93 mg/l >2000 mg/kg 4233 mg/kg	4 hours - -

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Conclusion/Summary

Skin : Not irritating / not corrosive to the skin (OECD TG 404)

Eyes : Not irritant / not corrosive to the eyes (OECD TG 405)

Respiratory : No known significant effects or critical hazards.

Sensitization

Conclusion/Summary

Skin : Sodium molybdate is not sensitising to the skin (OECD TG 406)

Respiratory : There is no data indicating respiratory sensitisation.

Mutagenicity

Conclusion/Summary

: Not a germ cell mutagen.
Negative test result in an in vivo micronucleus assay in rats (OECD TG 474). Negative test results in three in vitro tests: Bacterial reverse mutation assay (OECD TG 471), micronucleus assay in human lymphocytes (OECD TG 487), and gene mutation assay (tk) in mouse lymphoma cells (OECD TG 476).

Carcinogenicity

Conclusion/Summary

: Not a carcinogen.
Based on read-across for absence of systemic carcinogenicity, based on chronic toxicity and carcinogenicity studies with molybdenum trioxide. Local effects in the lung observed in these molybdenum trioxide studies are considered specific to molybdenum trioxide and not read-across to sodium molybdate.

Reproductive toxicity

Conclusion/Summary

: Sodium molybdate does not require hazard classification for effects on fertility or pre-natal development.

Unbounded NOAEL for reproductive toxicity (fertility) in a 2-generation study in rats (OECD TG 416): > 40 mg Mo/kgbw/day.

Unbounded NOAEL for developmental abnormalities and irreversible foetal effects in prenatal developmental toxicity studies in rats (OECD TG 414): > 120 mg Mo/kg bw/day.

Teratogenicity

Conclusion/Summary

: No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

None.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
Molybdenum		Ingestion	A 90-day oral toxicity study of molybdenum (as sodium molybdate in the diet) was carried out in rats (OECD TG 408). The overall NOAEL was 17 mg Mo/kgbw/day based on body weight depression and renal changes at 60 mg Mo/kgbw/day.

Aspiration hazard

Section 11. Toxicological information

None.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : No known significant effects or critical hazards.
Potential delayed effects : No known significant effects or critical hazards.

Long term exposure

Potential immediate effects : No known significant effects or critical hazards.
Potential delayed effects : No known significant effects or critical hazards.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
disodium molybdate	Sub-chronic NOAEL Oral	Rat	17 mg/kg/day	-

Conclusion/Summary : No known significant effects or critical hazards.
General : No known significant effects or critical hazards.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.
Developmental effects : No known significant effects or critical hazards.
Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

N/A

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
disodium molybdate	Acute EC50 295.0 - 390.9 mg Mo/L	Algae - <i>P. subcapitata</i>	72 hours
	289.2 - 369.6 mg Mo/L Fresh water		
	Acute LC50 1005.5 - 1024.6 mg Mo/L	Crustaceans - <i>Ceriodaphnia dubia</i>	48 hours
	Acute LC50 1680.4 - 1776.6 mg Mo/L	Crustaceans - <i>Daphnia magna</i>	48 hours
	Acute LC50 2729.4 mg Mo/L	Crustaceans - <i>Daphnia magna</i>	48 hours
	Acute LC50 130.9 mg Mo/L	Crustaceans - <i>Daphnia magna</i>	48 hours
	Acute LC50 1226 mg Mo/L	Crustaceans - <i>Girardia dorotocephala</i>	96 hours
	Acute LC50 7600 mg Mo/L Fresh water	Fish - <i>Oncorhynchus mykiss</i>	96 hours
	Acute LC50 781 - 1339 mg Mo/L Fresh water	Fish - <i>Oncorhynchus mykiss</i>	96 hours
	Acute LC50 609.1 - 681.4 mg Mo/L Fresh water	Fish - <i>Pimephales promelas</i>	96 hours
	Chronic EC50 1926 mg Mo/L	Micro-organism	3 hours respiration inhibition
	Chronic EC50 216.5 mg Mo/L	Micro-organism	3 hours respiration inhibition
	Chronic NOEC 4.4 - 1174 mg Mo/L Marine water	Crustaceans - <i>Mytilus edulis</i> and other similar group species	-
	Chronic NOEC 43.2 - 241.5 mg Mo/L Fresh water	Fish - <i>oncorhynchus mykiss</i> and other similar group species	-
	Chronic NOEC >950 mg Mo/L	Micro-organism	30 minutes O2 utilization

Conclusion/Summary : Sodium molybdate dihydrate is not hazardous to the aquatic environment.

Persistence and degradability

Conclusion/Summary : Sodium molybdate – when released into the environment - will rapidly dissolve and will be present as the molybdate species (MoO_4^{2-}) under normal environmental conditions.

Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Molybdenum			Available BCF/BAF data for the aquatic environment show a distinct inverse relationship with the exposure concentration. This finding demonstrates that molybdenum is homeostatically controlled by these organisms up to the milligram range of exposure. Available information on transfer of molybdenum through the food chain indicates that molybdenum does not biomagnify in aquatic food chains. Although not homeostatically controlled in terrestrial plants and invertebrates, molybdenum is not largely concentrated from soil into plants, or soil to invertebrates. There is no significant concentration increase from diet to mammals or birds. It is concluded that biomagnification is not significant in the terrestrial

Section 12. Ecological information

foodchain.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Mobility : Molybdate originating from sodium molybdate dihydrate is soluble in water and with its relatively low K_d value, the molybdate ions are leachable through normal soil and are mobile in sediment. Typical log K_d -values of 3.25 and 2.94 have been determined for sediment and soil, respectively.

Other adverse effects : Molybdate originating from sodium molybdate dihydrate can contribute to the onset of molybdenosis (which is a molybdenum-induced copper deficiency) in ruminants such as cattle, deer, and sheep. The level and bio-availability of copper in the animal diet are critical factors in the onset of molybdenosis. The recommended minimum dietary Cu: Mo mass ratio threshold to prevent molybdenosis is 1.30, i.e. there should be 30% more copper than molybdenum in the diet (note: mass ratio, not molar ratio). Cu & Mo content in the diet can be monitored, and if the ratio is < 1.3 then provide Cu supplements such as copper sulphate enriched feeds or copper sulphate enriched salt blocks for ruminants to use ad libitum. If there are ruminants in the vicinity of the plant, identify direct and diffuse air emission sources at the plant and carry out and record emission minimization measures. Have an animal health check programme in place (e.g. blood tests for copper) to verify that the measures are effective.

Sodium molybdate dihydrate is not expected to contribute to ozone depletion, ozone formation, global warming or acidification.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	Not regulated as dangerous goods.	Not regulated as dangerous goods.	Not regulated as dangerous goods.
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	No.	No.	No.

Section 14. Transport information

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : **Remarks** : Not regulated as dangerous goods.

Section 15. Regulatory information

U.S. Federal regulations : TSCA 8(a) CDR Exempt/Partial exemption: No.
United States inventory (TSCA 8b): Anhydrous form is "active".

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

State regulations

Massachusetts : None of the components are listed.

New York : None of the components are listed.

New Jersey : None of the components are listed.

Pennsylvania : None of the components are listed.

California Prop. 65

 **WARNING:** This product can expose you to chemicals including Crystalline silica, which is known to the State of California to cause cancer, and lead, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warning.ca.gov

Ingredient name	No significant risk level	Maximum acceptable dosage level
Silica, crystalline	-	-

International regulations

Montreal Protocol

Not listed.

National inventory

Section 15. Regulatory information

Canada : All components are listed or exempted.

Section 16. Other information

Procedure used to derive the classification

Classification	Justification
Not classified.	

History

Date of issue/Date of revision : 9/20/2023

Date of previous issue : 9/20/2023

Version / Version comments : 1

Key to abbreviations/ Revision comments :

- ATE = Acute Toxicity Estimate
- BCF = Bioconcentration Factor
- GHS = Globally Harmonized System of Classification and Labelling of Chemicals
- IATA = International Air Transport Association
- IBC = Intermediate Bulk Container
- IMDG = International Maritime Dangerous Goods
- LogPow = logarithm of the octanol/water partition coefficient
- MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
- N/A = Not available
- UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

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