

MOLYBDENUM DISULPHIDE

GHS Safety Data Sheet

Version No:4

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Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

MOLYBDENUM DISULFIDE

OTHER NAMES

Mo-S₂, "molybdenum (IV) sulfide", "molybdenum (IV) sulfide"
 "molybdic sulfide", molybdenite

PRODUCT USE

Heat resistant lubricants in greases, oil dispersions, resinbonded films, dry powders; hydrogenation catalyst, anti-seize compounds.

SUPPLIER

Company: S D FINE- CHEM LIMITED

Address:

315- 317, T.V. INDUSTRIAL ESTATE,

248, WORLI,

MUMBAI- 400030.INDIA.

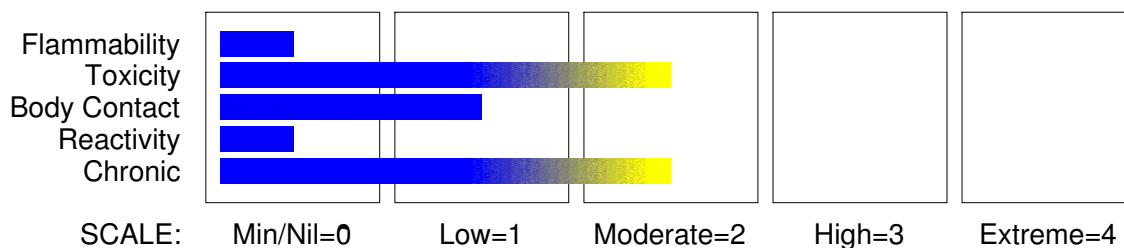
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HAZARD RATINGS



Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Organ Damage Category 2



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Section 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

HAZARD

WARNING

Determined by using GHS criteria:

H373

May cause damage to organs through prolonged or repeated exposure.

PRECAUTIONARY STATEMENTS

Prevention

Do not breathe dust/fume/gas/mist/vapours/spray.

Response

Get medical advice/attention if you feel unwell.

Disposal

Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
molybdenum disulfide	1317-33-5	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.

EYE

If this product comes in contact with the eyes:

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

- If dust is inhaled, remove from contaminated area.

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Section 4 - FIRST AID MEASURES

- Encourage patient to blow nose to ensure clear passage of breathing.
- If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN

For exposures involving sulfides and hydrogen sulfide (including gastric acid decomposition products of alkaline sulfides):

- Hydrogen sulfide anion produces its major toxic effect through inhibition of cytochrome oxidases.
- Symptoms include profuse salivation, nausea, vomiting and diarrhea. Central nervous effects may include giddiness, headache, vertigo, amnesia, confusion and unconsciousness. Tachypnoea, palpitations, tachycardia, arrhythmia, sweating, weakness and muscle cramps may also indicate overexposure.

Treatment involves:

- If respirations are depressed, application of artificial respiration, administration of oxygen (continue after spontaneous breathing is established).
- For severe poisonings administer amyl nitrite and sodium nitrite (as for cyanide poisoning) but omit sodium thiosulfate injection.
- Atropine sulfate (0.6 mg intramuscularly) may contribute symptomatic relief.
- Conjunctivitis may be relieved by installation of 1 drop of olive-oil in each eye and sometimes by 3 drops of epinephrine solution (1:1000) at frequent intervals. Occasionally local anesthetics and hot and cold compresses are necessary to control pain.
- Antibiotics at first hint of pulmonary infection.

[Gosselin etal, Clinical Toxicology of Commercial Products].

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Use fire fighting procedures suitable for surrounding area.

FIRE FIGHTING

Alert Fire Brigade and tell them location and nature of hazard.

- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.

Cool fire exposed containers with water spray from a protected location.

DO NOT approach containers suspected to be hot.

If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD

- Non combustible.
 - Not considered a significant fire risk, however containers may burn.
- Decomposes on heating and produces toxic fumes of sulfur oxides (SOx).

Personal Protective Equipment

Breathing apparatus.

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

Wear impervious gloves and safety glasses.

Clean up all spills immediately.

Avoid contact with skin and eyes.

Vacuum up or sweep up.

Use dry clean up procedures and avoid generating dust.

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Section 6 - ACCIDENTAL RELEASE MEASURES

Place in suitable containers for disposal.

MAJOR SPILLS

Alert Fire Brigade and tell them location and nature of hazard.

Clear area of personnel.

- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.

Shut off all possible sources of ignition and increase ventilation.

Stop leak if safe to do so.

Use dry clean up procedures and avoid generating dust.

Collect recoverable product into labelled containers for recycling.

Collect residues and seal in labelled drums for disposal.

Wash spill area with detergent and water.

After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

molybdenum disulfide 500 mg/m³

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

molybdenum disulfide 75 mg/m³

other than mild, transient adverse effects without perceiving a clearly defined odour is:

molybdenum disulfide 50 mg/m³

The threshold concentration below which most people will experience no appreciable risk of health effects:

molybdenum disulfide 15 mg/m³

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	$\geq 0.1\%$	Toxic (T)	$\geq 3.0\%$
R50	$\geq 0.25\%$	Corrosive (C)	$\geq 5.0\%$
R51	$\geq 2.5\%$		
else	$\geq 10\%$		

where percentage is percentage of ingredient found in the mixture

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



+: May be stored together

O: May be stored together with specific precautions

X: Must not be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

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Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

Use good occupational work practice.
Avoid generating and breathing dust.
Avoid contact with skin and eyes.
Wear protective clothing when risk of exposure occurs.
Avoid contact with incompatible materials.
Use in a well-ventilated area.
Avoid physical damage to containers.
Keep containers securely sealed when not in use.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.

SUITABLE CONTAINER

Packaging as recommended by manufacturer.
· Check that containers are clearly labelled.
Metal can.
Metal drum.

STORAGE INCOMPATIBILITY

Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS

Observe manufacturer's storing and handling recommendations.
Store away from sources of heat or ignition / naked lights.
Keep containers securely sealed.
Store in a cool, dry place.
Store in a well-ventilated area.
Store away from strong oxidisers.
Check regularly for spills and leaks.
Protect containers against physical damage.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records
• molybdenum disulfide: CAS:1317- 33- 5 CAS:56780- 54- 2 CAS:37297- 03- 3

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
molybdenum disulfide	5, 000	

MATERIAL DATA

An increased incidence of non-specific symptoms including headache, weakness, fatigue, anorexia and joint and muscle weakness has been reported to occur in mining and metallurgy workers exposed to 60-600 mg (as Mo). Some investigators have attributed gout and elevated uric acid concentration found in some Armenians to result from exposures to Armenian soils rich in molybdenum, whilst exposure has been implicated as a cause of bone disease amongst Indians. "These involvements are speculative". [US National Research Council]. As far as it is known, the recommended TLV-TWA incorporates a large margin of

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

safety against potential pulmonary or systemic effects.

The concentration of respirable dust for application of this limit is to be determined from the fraction that penetrates a separator whose size collection efficiency is described by a cumulative lognormal function with a median aerodynamic diameter of $4.0\text{ }\mu\text{m}$ (+-) $0.3\text{ }\mu\text{m}$ and with a geometric standard deviation of $1.5\text{ }\mu\text{m}$ (+-) $0.1\text{ }\mu\text{m}$, i.e..generally less than $5\text{ }\mu\text{m}$.

PERSONAL PROTECTION



EYE

- Chemical goggles.
- Safety glasses.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

- Impervious gloves.
- Plastic gloves.
- PVC gloves.
- Rubber gloves.
- Protective footwear.

OTHER

- Overalls.
- Eyewash unit.

RESPIRATOR

Protection Factor	Half- Face Respirator	Full- Face Respirator	Powered Air Respirator
10 x ES	P1 Air- line*	- -	PAPR- P1 -
50 x ES	Air- line**	P2	PAPR- P2
100 x ES	-	P3	-
		Air- line*	-
100+ x ES	-	Air- line**	PAPR- P3

* - Negative pressure demand ** - Continuous flow.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.
For further information consult your Occupational Health and Safety Advisor.

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS

General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear SAA approved respirator. Correct fit is essential to obtain adequate protection. Provide adequate ventilation in warehouse or closed storage areas. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air)	0.25- 0.5 m/s (50- 100 f/min)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5- 1 m/s (100- 200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1- 2.5 m/s (200- 500 f/min)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood - local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Black, crystalline powder; insoluble in water.
Insoluble in dilute acid and concentrated sulfuric acid.
Soluble in hot sulfuric acid and aqua regia.
Decomposes in air. (SAX)

PHYSICAL PROPERTIES

Solid.
Does not mix with water.

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Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Sinks in water.

Molecular Weight: 160.06
Melting Range (°C): Sublimes @ 450C
Solubility in water (g/L): Immiscible
pH (1% solution): Not applicable.
Volatile Component (%vol): Not applicable
Relative Vapour Density (air=1): Not applicable
Lower Explosive Limit (%): Not applicable
Autoignition Temp (°C): Not available
State: Divided solid

Boiling Range (°C): 1185
Specific Gravity (water=1): 4.80 @ 14 deg.C
pH (as supplied): Not applicable
Vapour Pressure (kPa): Not applicable
Evaporation Rate: Not applicable
Flash Point (°C): Non combustible
Upper Explosive Limit (%): Not applicable
Decomposition Temp (°C): >400
Viscosity: Not available

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

Presence of incompatible materials.
Storage in unsealed containers.
Hazardous polymerisation will not occur.
Stable under normal storage conditions.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be damaging to the health of the individual. The material is regarded as being of low oral toxicity. Considered an unlikely route of entry in commercial/industrial environments. Ingestion of sulfide salts may result in their decomposition by stomach gastric acid to hydrogen sulfide with systemic poisoning. Symptoms may include headache, respiratory depression, cyanosis, fall of blood pressure, loss of consciousness, tremors and convulsions. Molybdenum is of biological importance as an essential trace element in the Mo-flavoprotein enzyme, xanthine oxidase. It is also necessary for nitrogen-fixation by soil bacteria; livestock poisoning has been recorded in animals feeding on herbage containing high levels of molybdenum. Signs of molybdenum poisoning include loss of appetite, listlessness, diarrhoea and reduced growth rate. Anaemia is characteristic of molybdenum toxicity with low haemoglobin concentration and reduced red blood cell count. Livers and kidneys of severely poisoned animals show fatty degeneration. Other symptoms include achromotrichia (loss of hair pigment), testicular degeneration, poor conception and deficient lactation, dyspnoea, incoordination and irritation of the mucous membranes. Molybdenum depresses liver sulfide oxidase activity and the resulting sulfide accumulation leads to the formation of highly insoluble cupric sulfide and the subsequent appearance of copper deficiency. Symptoms of molybdenosis described above are similar to those of hypocuprosis.

EYE

Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn). The dust may produce eye discomfort causing transient smarting, blinking.

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Section 11 - TOXICOLOGICAL INFORMATION

SKIN

The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.

Open cuts, abraded or irritated skin should not be exposed to this material.

Prolonged or repeated skin contact may cause drying with cracking, irritation and possible dermatitis following.

INHALED

Inhalation may produce health damage*.

The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation, of the material, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.

Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

Bronchial and alveolar exudate are apparent in animals exposed to molybdenum by inhalation. Molybdenum fume may produce bronchial irritation and moderate fatty changes in liver and kidney.

Effects on lungs are significantly enhanced in the presence of respirable particles.

Overexposure to respirable dust may produce wheezing, coughing and breathing difficulties leading to or symptomatic of impaired respiratory function.

CHRONIC HEALTH EFFECTS

Principal routes of exposure are by accidental skin and eye contact and inhalation of generated dusts.

Cattle, rabbits, and chicks on high dietary levels of molybdenum exhibited deformities of joints of the extremities. Chronic exposure of workers in Russian molybdenum-copper plant resulted in a fall in the albumin/globulin ratio owing to a rise in globulins (particularly alpha-globulins) which is interpreted as evidence of liver dysfunction with hyperbilirubinaemia. Hepatotoxic effects are also found in animals given molybdenum salts with a rise in alpha-globulin levels, hypoalbuminaemia and increased serum bilirubin reported. Other reported biochemical effects include an early depletive effect on tissue nicotinamide nucleotides, hyperaminoaciduria, reduction in red blood cell life-span and hyper-thyroidism. Industrial exposure to some insoluble molybdenum compounds is thought to have resulted in an increased incidence of weakness, fatigue, anorexia, headache and joint and muscular pain. Animals exposed to certain insoluble molybdenum compounds show anorexia, diarrhoea, weight loss, listlessness, and liver and kidney damage. Molybdenum disturbs bone metabolism, giving rise to lameness, bone joint abnormalities, osteoporosis and high serum phosphatase levels. Low molybdenum intake has been attributed to the high incidence of oesophageal cancer in South Africa among the Bantu of Transkei, in China and in Russia. Under the conditions of a 2-year inhalation study* there was equivocal evidence of carcinogenic activity of molybdenum trioxide in male rats, male mice and female mice based on a marginally significant positive trend of alveolar/bronchiolar adenoma or carcinoma. There was no evidence of carcinogenic activity in female rats exposed to 10, 30 and 100 mg/m³. Exposure of male and female rats to molybdenum trioxide by inhalation resulted in increased incidences of chronic alveolar inflammation, hyaline degeneration of the olfactory epithelium (females), hyaline degeneration of the respiratory epithelium and squamous metaplasia of the epiglottis. Exposure of female and male mice to molybdenum trioxide resulted in an increased incidence of metaplasia of the alveolar epithelium, histiocyte cellular inflammation (males), hyaline degeneration of the respiratory epithelium, hyaline degeneration of the olfactory epithelium (females), squamous metaplasia of the epiglottis, and hyperplasia of the larynx. Molybdenum trioxide was not mutagenic in any of five strains of *Salmonella typhimurium* and did not induce sister chromatid exchanges or chromosomal aberrations in cultured Chinese hamster ovary cells in vitro. All tests were conducted with or without S9 metabolic activation enzymes. National Toxicology Program: Technical Report Series 462, April 1997.

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Section 11 - TOXICOLOGICAL INFORMATION

TOXICITY AND IRRITATION

No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

No data for molybdenum disulfide.

Section 13 - DISPOSAL CONSIDERATIONS

Recycle wherever possible.
Consult State Land Waste Management Authority for disposal.
Bury or incinerate residue at an approved site.
Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM: None

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS:UN, IATA,
IMDG

Section 15 - REGULATORY INFORMATION

REGULATIONS

molybdenum disulfide (CAS: 1317-33-5) is found on the following regulatory lists;
OECD Representative List of High Production Volume (HPV) Chemicals

No data available for molybdenum disulfide as CAS: 56780-54-2, CAS: 37297-03-3.

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
molybdenum disulfide	1317- 33- 5, 56780- 54- 2, 37297- 03- 3

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

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