Material Safety Data Sheet

Section 1. Chemical Product and Company Identification

Common Name/Trade Name: 
Ammonium Molybdate Reagent II Solution

Manufacturer: 
SPECTRUM LABORATORY PRODUCTS INC.
14422 S. SAN PEDRO STREET
GARDENA, CA 90248

Commercial Name(s): Not available.
Synonym: Ammonium Molybdate Reagent II Solution for Phosphorous, APHA

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>TWA (mg/m³)</th>
<th>STEL (mg/m³)</th>
<th>CEIL (mg/m³)</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium molybdate tetrahydrate</td>
<td>12054-85-2</td>
<td>5</td>
<td></td>
<td></td>
<td>4.95</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>1</td>
<td>3</td>
<td></td>
<td>10.4</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td></td>
<td></td>
<td></td>
<td>84.7</td>
</tr>
</tbody>
</table>

Ammonium molybdate tetrahydrate:
ORAL (LD50): Acute: 333 mg/kg [Rat].

Sulfuric acid:
ORAL (LD50): Acute: 2140 mg/kg [Rat].
VAPOR (LC50): Acute: 510 mg/m³ 2 hours [Rat]. 320 mg/m³ 2 hours [Mouse].

Section 3. Hazards Identification

Potential Acute Health Effects: Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion. Hazardous in case of skin contact (corrosive, permeator), of eye contact (corrosive). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

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Potential Chronic Health Effects

Carcinogenic Effects: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Sulfuric acid].
Classified A2 (Suspected for human.) by ACGIH [Sulfuric acid].

Mutagenic Effects: Not available.
Teratogenic Effects: Not available.

Developmental Toxicity: Not available.

The substance may be toxic to kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4. First Aid Measures

Eye Contact
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion
Not available.

Section 5. Fire and Explosion Data

Flammability of the Product
Non-flammable.

Auto-Ignition Temperature
Not applicable.

Flash Points
Not applicable.

Flammable Limits
Not applicable.

Products of Combustion
Not available.

Fire Hazards in Presence of Various Substances
Not applicable.

Explosion Hazards in Presence of Various Substances
Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions
Not applicable.

Special Remarks on Fire Hazards
Not available.

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Ammonium Molybdate Reagent II Solution

Special Remarks on Explosion Hazards
Mixtures of sulfuric acid and any of the following can explode: p-nitrotoluene, pentasilver trihydroxydiaminophosphate, perchlorates, alcohols with strong hydrogen peroxide, ammonium tetaperoxyxochromate, mercuric nitrite, potassium chlorate, potassium permanganate with potassium chloride, carbides, nitro compounds, nitrates, carbides, phosphorous, iodides, picrates, fulminates, dienes, alcohols (when heated).
Nitramide decomposes explosively on contact with concentrated sulfuric acid.
1,3,5-Trinitrosohexahydro-1,3,5-triazine + sulfuric acid causes explosive decomposition. (Sulfuric acid)

Section 6. Accidental Release Measures

<table>
<thead>
<tr>
<th>Small Spill</th>
<th>Large Spill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.</td>
<td>Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.</td>
</tr>
</tbody>
</table>

Section 7. Handling and Storage

Precautions
Do not ingest. Do not breathe gas/fumes/vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage
Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8. Exposure Controls/Personal Protection

Engineering Controls
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection

Personal Protection in Case of a Large Spill
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits

<table>
<thead>
<tr>
<th>Ammonium molybdate tetrahydrate</th>
<th>Sulfuric acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA: 5 (mg(Mo)/m³) from OSHA (PEL) [United States]</td>
<td>TWA: 1 STEL: 3 (mg/m³) [Australia] Inhalation</td>
</tr>
<tr>
<td>TWA: 0.5 (mg(Mo)/m³) from ACGIH (TLV) [United States] Inhalation Respirable.</td>
<td>TWA: 1 (mg/m³) from OSHA (PEL) [United States] Inhalation</td>
</tr>
<tr>
<td>TWA: 5 (mg(Mo)/m³) from ACGIH (TLV) [United States]</td>
<td>TWA: 1 STEL: 3 (mg/m³) from ACGIH (TLV) [United States] [1999] Inhalation</td>
</tr>
<tr>
<td>TWA: 5 STEL: 10 (mg(Mo)/m³) [United Kingdom (UK)]</td>
<td>TWA: 1 (mg/m³) from NIOSH [United States] Inhalation</td>
</tr>
<tr>
<td>TWA: 5 (mg(Mo)/m³) [Belgium]</td>
<td>TWA: 5 (mg(Mo)/m³) [Switzerland]</td>
</tr>
<tr>
<td>TWA: 5 (mg(Mo)/m³) [Denmark]</td>
<td>TWA: 5 (mg(Mo)/m³) [Switzerland]</td>
</tr>
<tr>
<td>TWA: 5 (mg(Mo)/m³) [Austria]</td>
<td></td>
</tr>
<tr>
<td>TWA: 5 (mg(Mo)/m³) [Switzerland]</td>
<td></td>
</tr>
</tbody>
</table>

Sulfuric acid
TWA: 1 (mg/m³) [United Kingdom (UK)]

Consult local authorities for acceptable exposure limits.
### Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Physical state and appearance</th>
<th>Liquid.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>pH (1% soln/water)</td>
<td>Acidic.</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>The lowest known value is 100°C (212°F) (Water). Weighted average: 147.6°C (297.7°F)</td>
</tr>
<tr>
<td>Melting Point</td>
<td>May start to solidify at -35°C (-31°F) based on data for: Sulfuric acid.</td>
</tr>
<tr>
<td>Critical Temperature</td>
<td>Not available.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Weighted average: 1.16 (Water = 1)</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>The highest known value is 2.3 kPa (@ 20°C) (Water).</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>The highest known value is 3.4 (Air = 1) (Sulfuric acid). Weighted average: 1.4 (Air = 1)</td>
</tr>
<tr>
<td>Volatility</td>
<td>Not available.</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available.</td>
</tr>
<tr>
<td>Water/Oil Dist. Coeff.</td>
<td>Not available.</td>
</tr>
<tr>
<td>Ionicity (in Water)</td>
<td>Not available.</td>
</tr>
<tr>
<td>Dispersion Properties</td>
<td>See solubility in water.</td>
</tr>
<tr>
<td>Solubility Properties</td>
<td>Easily soluble in cold water.</td>
</tr>
</tbody>
</table>

### Section 10. Stability and Reactivity Data

| Stability                      | The product is stable. |
| Instability Temperature        | Not available. |
| Conditions of Instability      | Incompatible materials |
| Incompatibility with various substances | Slightly reactive to reactive with oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis. |
| Corrosivity                    | Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass. |
| Special Remarks on Reactivity  | Hygroscopic. Strong oxidizer. Reacts violently with water and alcohol especially when water is added to the product. Incompatible (can react explosively or dangerously) with the following: ACETIC ACID, ACRYLIC ACID, AMMONIUM HYDROXIDE, CRESOL, CUMENE, DICHLOROETHYL ETHER, ETHYLENE CYANOHYDRIN, ETHYLENEIMINE, NITRIC ACID, 2-NITROPROPANE, PROPYLENE OXIDE, SULFOLANE, VINYLIDENE CHLORIDE, DIETHYLENE GLYCOL MONOMETHYL ETHER, ETHYL ACETATE, ETHYLENE CYANOHYDRIN, ETHYLENE GLYCOL MONOETHYL ETHER ACETATE, GLYOXAL, METHYL ETHYL KETONE, dehydrating agents, organic materials, moisture (water), Acetic anhydride, Acetone, cyanoxydrin, Acetone-nitric acid, Acetone + potassium dichromate, Acetonitrile, Acrolein, Acrylonitrile, Acrylonitrile-water, Alcohols + hydrogen peroxide, ally compounds such as Allyl alcohol, and Allyl Chloride, 2-Aminoethanol, Ammonium hydroxide, Ammonium triperchlorate, Aniline, Bromate + metals, Bromine pentfluoride, n-Butylaldehyde, Carbides, Cesium acetylene carbide, Chlorates, Cyclopentanone oxime, chlorinates, Chlorates + metals, Chlorine trifluoride, Chlorosulfonic acid, 2-cyano-4-nitrobenzenediazonium hydrogen sulfate, Cuprous nitride, p-Chloronitrobenzene, 1,5-Dinitronaphthylene + sulfur, Diisobutylene, p-Dimethylaminobenzaldehyde, 1,3-Diazidobenzene, Dimethylbenzylcarbinol + hydrogen peroxide, Epichlorohydrin, Ethyl alcohol + hydrogen peroxide, Ethylene diamine, Ethylene glycol and other glycols, Ethylenimine, Fulminates, hydrogen peroxide, Hydrochloric acid, Hydrofluoric acid, Iodine heptafluoride, Indane + nitric acid, Iron, Isoprene, Lithium silicide, Mercuric nitride, Mesityl oxide, Mercury nitride, Metals (powdered), Nitromethane, Nitric acid + glycides, p-Nitrotoluene, Pentasilver trihydroxidaminophosphate, Perchlorates, Perchloric acid, Permanganates + benzene, 1-Pheny1-2-methylpropyl alcohol + hydrogen peroxide, Phosphorus, Phosphorus isocyanate, Picrates, Potassium tert-butoxide, Potassium chlorate, Potassium Permanganate and other permanganes, halogens, amines, Potassium Permanganate + Potassium chloride, Potassium Permanganate + water, Propiolactone (beta)-, Pyridine, Rubidium acetylene carbide, Silver permanganate, Sodium, Sodium carbonate, sodium hydroxide, |
### Ammonium Molybdate Reagent II Solution

Steel, styrene monomer, toluene + nitric acid, Vinyl acetate, Thallium (I) azidodithiocarbonate, Zinc chlorate, Zinc iodide, azides, carbonates, cyanides, sulfides, sulfites, alkali hydrides, carboxylic acid anhydrides, nitriles, olefinic organics, aqueous acids, cyclopentadiene, cyano-alcohols, metal acetylides,

Hydrogen gas is generated by the action of the acid on most metals (i.e. lead, copper, tin, zinc, aluminum, etc.). Concentrated sulfuric acid oxidizes, dehydrates, or sulfonates most organic compounds.

<table>
<thead>
<tr>
<th>Special Remarks on Corrosivity</th>
<th>Non-corrosive to lead and mild steel, but dilute acid attacks most metals. Attacks many metals releasing hydrogen. Minor corrosive effect on bronze. No corrosion data on brass or zinc.</th>
</tr>
</thead>
</table>

### Section 11. Toxicological Information

<table>
<thead>
<tr>
<th>Routes of Entry</th>
<th>Absorbed through skin.  Dermal contact.  Eye contact.  Inhalation.  Ingestion.</th>
</tr>
</thead>
</table>

**Toxicity to Animals**

Acute oral toxicity (LD50): 4935 mg/kg (Rat) (Calculated value for the mixture).

**Chronic Effects on Humans**

CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, + (Proven.) by OSHA [Sulfuric acid]. Classified A2 (Suspected for human.) by ACGIH [Sulfuric acid].

Contains material which may cause damage to the following organs: kidneys, lungs, heart, cardiovascular system, upper respiratory tract, eyes, teeth.

**Other Toxic Effects on Humans**

Very hazardous in case of skin contact (irritant), of ingestion. Hazardous in case of skin contact (corrosive, permeator), of eye contact (corrosive), of inhalation (lung corrosive).

<table>
<thead>
<tr>
<th>Special Remarks on Toxicity to Animals</th>
<th>Lowest Published Lethal Dose:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL [Rabbit] - Route: Oral; Dose: 1870 mg/kg</td>
<td></td>
</tr>
<tr>
<td>LDL [Guinea Pig] - Route: Oral; Dose: 2200 mg/kg</td>
<td></td>
</tr>
<tr>
<td>LDL [Cat] - Route: Oral; Dose: 1600 mg/kg (Ammonium molybdate tetrahydrate)</td>
<td></td>
</tr>
</tbody>
</table>

**Special Remarks on Chronic Effects on Humans**

Mutagenicity: Cytogenetic Analysis: Hamster, ovary = 4mmol/L
Reproductive effects: May cause adverse reproductive effects based on animal data. Developmental abnormalities (musculoskeletal) in rabbits at a dose of 20 mg/m3 for 7 hrs. (RTECS)
Teratogenicity: neither embryotoxic, fetotoxic, nor teratogenic in mice or rabbits at inhaled doses producing some maternal toxicity (Sulfuric acid)

**Special Remarks on other Toxic Effects on Humans**

Sulfuric Acid:
Acute Potential Health Effects:
Skin: Causes severe skin irritation and burns. Continued contact can cause tissue necrosis. Eye: Causes severe eye irritation and burns. May cause irreversible eye injury.
Ingestion: Harmful if swallowed. May cause permanent damage to the digestive tract. Causes gastrointestinal tract burns. May cause perforation of the stomach, GI bleeding, edema of the glottis, necrosis and scarring, and sudden circulatory collapse (similar to acute inhalation). It may also cause systemic toxicity with acidosis.
Inhalation: May cause severe irritation of the respiratory tract and mucous membranes with sore throat, coughing, shortness of breath, and delayed lung edema. Causes chemical burns to the respiratory tract. Inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Cause corrosive action on mucous membranes. May affect cardiovascular system (hypotension, depressed cardiac output, bradycardia). Circulatory collapse with clammy skin, weak and rapid pulse, shallow respiration, and scanty urine may follow. Circulatory shock is often the immediate cause of death. May also affect teeth (changes in teeth and supporting structures - erosion, discoloration).
Chronic Potential Health Effects:
Inhalation: Prolonged or repeated inhalation may affect behavior (muscle contraction or spasticity), urinary system (kidney damage), and cardiovascular system, heart (ischemic heart leisions), and respiratory system/lungs (pulmonary edema, lung damage), teeth (dental discoloration, erosion).
Skin: Prolonged or repeated skin contact may cause dermatitis, an allergic skin reaction.
Ammonium Molybdate Tetrahydrate:
Acute Potential Health Effects:
Skin: Causes skin irritation. Eye: Causes eye irritation.
Inhalation: Causes upper respiratory tract (nose, throat) irritation causing coughing and wheezing. May affect the blood (changes in red and white blood cell counts, anemia)
Ingestion: Large doses may cause colic, gout, diarrhea, listlessness, trembling, headache, weakness, fatigue, incoordinated movements, dyspnea, anoxemia, loss of weight, joint and muscle pain. Molybdenum ingestion is associated with depleted copper stores in the body.
Chronic Potential Health Effects:
Ingestion and Inhalation: Prolonged or repeated ingestion or inhalation of Molybdenum/Molybdenum compounds may affect the blood and cause anemia. Anemia is a characteristic feature of Molybdenum toxicity. Prolonged or repeated ingestion of Molybdenum may also deplete copper stores in the body, and cause symptoms similar to that of acute ingestion.

Medical Conditions Aggravated by Exposure: People who have an inadequate intake of dietary intake of copper, or some dysfunction in their copper metabolism could be at greater risk for Molybdenum toxicity.

Section 12. Ecological Information

Ecotoxicity Not available.

BOD5 and COD Not available.

Products of Biodegradation Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation Not available.

Section 13. Disposal Considerations

Waste Disposal Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14. Transport Information

DOT Classification Class 8: Corrosive material

Identification: Corrosive Liquid, Acidic, Inorganic, n.o.s.(Sulfuric Acid Solution) (Sulfuric acid) UNNA: 3264 PG: II

Special Provisions for Transport Not available.

DOT (Pictograms)

Section 15. Other Regulatory Information and Pictograms

Federal and State Regulations Illinois toxic substances disclosure to employee act: Sulfuric acid

New York release reporting list: Sulfuric acid

Rhode Island RTK hazardous substances: Sulfuric acid

Pennsylvania RTK: Sulfuric acid

Minnesota: Ammonium molybdate tetrahydrate (Listed as Molybdenum, as Mo, Soluble/Insoluble Compounds);

Sulfuric acid

Massachusetts RTK: Sulfuric acid

New Jersey: Sulfuric acid

California Director's List of Hazardous Substances: Sulfuric acid

TSCA 8(b) inventory: Sulfuric acid; Water,

Ammonium Molybdate, tetrahydrate is not on the TSCA inventory list because it is a hydrate.

SARA 302/304/311/312 extremely hazardous substances: Sulfuric acid

SARA 313 toxic chemical notification and release reporting: Sulfuric acid 27.3%

CERCLA: Hazardous substances.: Sulfuric acid; 1000 lbs. (453.6 kg);

California Proposition 65 Warnings California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: No products were found.

California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: No products were found.
Ammonium Molybdate Reagent II Solution

Other Regulations

Other Classifications
| WHMIS (Canada) | CLASS E: Corrosive liquid. |
| DSCL (EEC)     | R34- Causes burns.         |

CLASS E: Corrosive liquid.

S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.)

| Health Hazard | 3 |
| Fire Hazard   | 0 |
| Reactivity    | 0 |
| Personal Protection | 0 |

National Fire Protection Association (U.S.A.)

| Health | 2 |
| Flammability | 0 |
| Reactivity | 1 |
| Specific hazard | 1 |

WHMIS (Canada) (Pictograms)

DSCL (Europe) (Pictograms)

TDG (Canada) (Pictograms)

ADR (Europe) (Pictograms)

Protective Equipment

Gloves.

Full suit.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Face shield.

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## Section 16. Other Information

<table>
<thead>
<tr>
<th>MSDS Code</th>
<th>A175S</th>
</tr>
</thead>
<tbody>
<tr>
<td>References</td>
<td>Not available.</td>
</tr>
<tr>
<td>Other Special Considerations</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

### Notice to Reader

All chemicals may pose unknown hazards and should be used with caution. This Material Safety Data Sheet (MSDS) applies only to the material as packaged. If this product is combined with other materials, deteriorates, or becomes contaminated, it may pose hazards not mentioned in this MSDS. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. While this MSDS is based on technical data judged to be reliable, Spectrum Quality Products, Inc. assumes no responsibility for the completeness or accuracy of the information contained herein.