SILVER FERN CHEMICAL, INC.
Safety Data Sheet
Glyoxal 40%

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifier
Product Name: Glyoxal 40% (solution in water)
Synonym(s): Biformyl; Ethanedial; 1,2-Ethanedione; Glyoxylaldehyde; Oxalaldehyde

1.2 Relevant identified uses of the substance or mixture and uses advised against
General use: Industrial applications
Uses advised against: None known

1.3 Details of the supplier and of the safety data sheet
Manufacturer/Distributor
Silver Fern Chemical, Inc.
2226 Queen Anne Avenue North
Suite C
Seattle, WA 98109 USA
1-866-282-3384
Website - www.silverfernchemical.com; email address - info@silverfernchemical.com

1.4 Emergency telephone number: INFO-TRAC +1-800-535-5053; Outside USA & Canada +1-352-323-3500

SECTION 2 - HAZARDS IDENTIFICATION

2.1 Classification of substance or mixture
Product definition: Mixture
Classification in accordance with 29 CFR 1910 (OSHA HCS) and Regulation EC No. 1272/2008
Skin irritation - Category 2 [H315]
Skin sensitizer - Category 1 [H317]
Eye irritation - Category 2A [H319]
Acute toxicity, inhalation - Category 4 [H332]
Germ cell mutagenicity - Category 2 [H341]

2.2 Label Elements
Hazard Symbol(s):

Signal Word: Warning
Hazard Statement(s):
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H319 - Causes serious eye irritation
H332 - Harmful if inhaled
H341 - Suspected of causing genetic defects

Precautionary Statements:
[Prevention]
P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing mist and vapors.
P264 - Wash hands and other skin areas exposed to material thoroughly after handling.
P271 - Use only outdoors or in a well-ventilated area.
P272 - Contaminated work clothing should not be allowed out of the workplace.
P280 - Wear protective gloves, protective clothing and eye protection.

[Response]
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water.
P362 - Take off contaminated clothing and wash before reuse.
P333 + P337 + P313 - If skin irritation or rash occurs or if eye irritation persists: Get medical attention.
P304 + P340 + P312 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a Poison Center or doctor if the victim feels unwell.
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
SECTION 4 - FIRST AID MEASURES

4.1 Description of first aid measures

Inhalation: If product mist or vapor causes respiratory irritation or distress, move the exposed person to fresh air immediately. If breathing is difficult or irregular, administer oxygen; if respiratory arrest occurs, start artificial respiration by trained personnel. If unconscious, maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. If irritation persists, seek medical assistance.

Eyes: Immediately flush eyes with large amounts of water or saline solution for at least 15 minutes, occasionally lifting the upper and lower lids. Remove contact lenses, if present and easy to do, after first 2 minutes and continue rinsing. If irritation persists, seek medical advice, preferably from an ophthalmologist.

Skin: Flush skin with large amounts of water while removing contaminated clothing. Wash the affected area with soap and water and continue rinsing. Wash contaminated clothing and shoes thoroughly before reuse. If irritation persists, seek medical attention.

Ingestion: Rinse mouth with water if the victim is conscious. Remove dentures, if present. Do not induce vomiting unless directed to do so by medical personnel. Vomiting may occur spontaneously. Never give anything by mouth to an unconscious or convulsing person. Do not leave the victim unattended. Seek medical attention if the victim feels unwell or is a large quantity of material has been ingested.

4.2 Most important symptoms and effects, both acute and delayed

Potential health symptoms and effects

Eyes: Causes serious eye irritation with inflammation, pain and tearing.

Skin: Causes skin irritation with redness, itching, discomfort. May cause skin discoloration (yellow). May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Glyoxal is considered to be a strong human sensitizer. May be harmful if absorbed through the skin.

Inhalation: Harmful if inhaled. Inhalation of mist or vapor may cause irritation of the respiratory tract.

Ingestion: May cause irritation of the digestive tract with nausea, vomiting, abdominal pain and diarrhea. May be harmful if swallowed.

Chronic: Prolonged or repeated skin contact may cause dermatitis. Exposure to high concentrations may cause depression of the central nervous system. Possible risk of irreversible effects. Prolonged or repeated exposure may cause damage to the kidneys.

4.3 Indication of any immediate medical attention and special treatment needed

Advice to Doctor and Hospital Personnel

Treat symptomatically and supportively.

SECTION 5 - FIRE FIGHTING MEASURES

5.1 Extinguishable media

Suitable methods of extinction: Use extinguishing media such as water spray or fog, carbon dioxide, foam and dry chemical.

Unsuitable methods of extinction: None known

5.2 Special hazards arising from the substance or mixture

Closed containers may explode due to the buildup of pressure when exposed to extreme heat. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent or may be delayed. Obtain medical attention.

Explosion hazards: Not considered to be an explosion hazard

5.3 Advice for firefighters

Full protective equipment including self-contained breathing apparatus should be used. Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion when exposed to extreme heat. If possible, firefighters should control runoff water to prevent environmental contamination.

Effective Date: 13 February 2017
Supercedes: 20 April 2015
SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Evacuate non-essential personnel. Ventilate the area. Remove all sources of ignition. Wear appropriate protective clothing and equipment designated in Section 8.

6.2 Environmental precautions
Avoid dispersal of spilled material or runoff and prevent contact with soil and entry into drains, sewers or waterways.

6.3 Methods and materials for containment and cleaning up
Clean up spills immediately. Cover drains and contain spill. Cover spill with a large quantity of inert absorbent. Do not use combustible material such as sawdust. Collect material and place into an approved container(s) for proper disposal. Observe possible material restrictions (Sections 7.2 and 10.5). Do not allow material or runoff from rinsing contaminated areas to enter floor drains or storm drains and ditches that lead to waterways. Dispose of via a licensed waste disposal contractor.

6.4 Reference to other sections
For indications about waste treatment, see Section 13.

SECTION 7 - HANDLING AND STORAGE

7.1 Precautions for safe handling
Wear all appropriate personal protective equipment specified in Section 8. Do not get in eyes or on skin or clothing. Do not inhale mist or vapor. No smoking. If normal use of material presents a respiratory hazard, use only adequate ventilation or wear an appropriate respirator.
Advice on protection against fire and explosion
Not considered to be a fire or explosion hazard

7.2 Conditions for safe storage, including any incompatibilities
Store in dry, cool, well-ventilated areas away incompatible materials (see Section 10.5), food and drink. Transfer only to approved containers having correct labeling. Keep containers tightly closed when not in use. Protect containers against physical damage. Containers that have been opened must be carefully resealed and kept upright to prevent spillage. Containers are hazardous when empty as they contain product residues. Use appropriate containment to avoid environmental contamination. Ventilate closed areas. Do not take internally. Keep out of reach of children.

7.3 Specific end uses
Apart from the uses mentioned in Section 1.2, no other specific uses are stipulated.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters
Occupational exposure limits

<table>
<thead>
<tr>
<th>CAS Number</th>
<th>Ingredient</th>
<th>OSHA - PEL</th>
<th>ACGIH</th>
<th>NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>107-22-2</td>
<td>Glyoxal</td>
<td>0.04 ppm; 0.1 mg/m³ TWA</td>
<td>Inhalable fraction and vapor</td>
<td></td>
</tr>
</tbody>
</table>

8.2 Exposure controls
Engineering measures: Technical measures and appropriate working operations should be given priority over the use of personal protective equipment. Use adequate ventilation. Local exhaust is preferable.
Individual protection measures: Wear protective clothing to prevent repeated or prolonged contact with product. Protective clothing needs to be selected specifically for the workplace, depending on concentrations and quantities of hazardous substances handled. The chemical resistance of the protective equipment should be enquired at the representative supplier.
Hygiene measures: Facilities storing or using this material should be equipped with an eyewash station and safety shower. Change contaminated clothing. Preventive skin protection is recommended. Wash hands thoroughly after use, before eating, drinking, smoking or using the lavatory.
Eye/face protection: Wear safety glasses with unperforated side shields or protective splash goggles during use.
Hand Protection: Wear gloves recommended by glove supplier for protection against materials in Section 3. Gloves should be impermeable to chemicals and oil. Breakthrough time of selected gloves must be greater than the intended use period.
Skin protection: Wear protective clothing. Wear protective boots if the situation requires.
Respiratory protection: Always use an approved respirator when vapor/aerosols are generated. Where risk assessment shows air-purifying respirators are appropriate use a full-faced respirator with multi-purpose combination (US) or type ABEK (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. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Follow OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149.
Environmental exposure controls: Do not empty into drains.
PPE must not be considered a long-term solution to exposure control. PPE usage must be accompanied by employer programs to properly select, maintain, clean fit and use. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers to ensure adequate protection.

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SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Clear, yellow liquid</td>
</tr>
<tr>
<td>Odor</td>
<td>Mild, sour</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>58.04 g/mol (Glyoxal)</td>
</tr>
<tr>
<td>Chemical Formula</td>
<td>C₂H₂O₂</td>
</tr>
<tr>
<td>pH</td>
<td>2.1 - 2.7</td>
</tr>
<tr>
<td>Freezing/Melting Point, Range</td>
<td>-25 °C (-13 °F)</td>
</tr>
<tr>
<td>Initial Boiling Point</td>
<td>110 °C (230 °F)</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash Point</td>
<td>86 °C (187 °F), closed cup</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>285 °C (545 °F), approximated</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower Explosive Limit (LEL)</td>
<td>No data available</td>
</tr>
<tr>
<td>Upper Explosive Limit (UEL)</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>20.2 hPa @ 20 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>2 (Air = 1)</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.27</td>
</tr>
<tr>
<td>Viscosity</td>
<td>8.37 mPa.s @ 20 °C</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Miscible @ 20 °C</td>
</tr>
<tr>
<td>Partition Coefficient: n-octanol/water</td>
<td>Miscible @ 20 °C</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Volatiles by Weight @ 21 °C</td>
<td>60%</td>
</tr>
</tbody>
</table>

9.2 Other data
No data available

SECTION 10 - STABILITY AND REACTIVITY

10.1 Reactivity
Stable under ordinary conditions of use and storage.

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Stable under ordinary conditions of use and storage. Hazardous polymerization may occur if the solution is allowed to evaporate to dry residue.

10.4 Conditions to avoid
Temperature extremes, contact with incompatible materials.

10.5 Incompatible materials
Strong oxidizing agents, strong bases

10.6 Hazardous decomposition products
Thermal decomposition products include oxides of carbon.

SECTION 11 - TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Oral Toxicity</td>
<td>LD₅₀, rat - &lt;5,000 mg/kg (male and female)</td>
</tr>
<tr>
<td>Acute inhalation toxicity</td>
<td>LC₅₀, rat - 2,410 mg/m³, 4 h</td>
</tr>
<tr>
<td>Acute dermal toxicity</td>
<td>LD₅₀, guinea pig - 6,600 mg/kg</td>
</tr>
<tr>
<td>Skin irritation</td>
<td>Causes skin irritation.</td>
</tr>
<tr>
<td>Eye irritation</td>
<td>Causes serious eye irritation.</td>
</tr>
<tr>
<td>Sensitization</td>
<td>May cause an allergic skin reaction</td>
</tr>
<tr>
<td>Genotoxicity in vitro</td>
<td>No data available</td>
</tr>
<tr>
<td>Mutagenicity</td>
<td>Suspected of causing genetic defects</td>
</tr>
</tbody>
</table>

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SECTION 12 - ECOLOGICAL INFORMATION

12.1 Toxicity
Large discharges or spills of this material may be harmful to aquatic life.

Acute and prolonged toxicity to fish:
- LC₅₀ - Brachidanio rerio (Zebrasfish), 48 h: 48 mg/l
- LC₅₀ - Leuciscus idus (Golden orfe), 96 h: 460 - 680 mg/l

Toxicity to aquatic invertebrates:
- EC₅₀ - Daphnia magna (Water flea), 48 h: 2,701 mg/l

12.2 Persistence and degradability
Readily biodegradable

12.3 Bioaccumulation potential
Bioaccumulation potential of this material is low.

12.4 Mobility in soil
Potential for mobility in soil is very high.

12.5 Results of PBT and vPvB assessment
No data available

12.6 Other adverse effects
Additional ecological information
Do not allow material to run into surface waters, wastewater or soil.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

SECTION 13 - DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Methods of disposal: The generation of waste should be avoided or minimized whenever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. 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. Avoid dispersal of spill material and runoff and contact with soil, waterways, drains and sewers.

RCRA P-Series: No listing
RCRA U-Series: No listing

SECTION 14 - TRANSPORT INFORMATION

Note: Transportation information provided is for reference only. Customer is urged to consult 49 CFR 100 - 177, IMDG, IATA, EC, United Nations TDG and WHMIS (Canada) TDG information manuals for detailed regulations and exceptions covering specific container sizes, packaging materials and methods of shipping.

NOT REGULATED FOR TRANSPORT

SECTION 15 - REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for substance or mixture

U. S. Federal Regulations

OSHA Hazard Communication Standard: This material is classified as hazardous in accordance with OSHA 29 CFR 1910-1200.
EPA Risk Management Planning Standard: This product is not regulated under EPA RMP Standard (RMP) 40 CFR Part 68.

EPA Federal Insecticide, Fungicide and Rodenticide Act: This product is not a registered Pesticide under the FIFRA, 40 CFR Part 150.

Toxic Substance Control Act (TSCA) Inventory: The components of this product are listed on the TSCA Inventory. It is not subject to TSCA 12(b) Export Notification.

Drug Enforcement Administration (DEA) List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.4(f)(2) and Chemical Code Number None listed

Drug Enforcement Administration (DEA) List s1 & 2, Exempt Chemical Mixtures (21 CFR 1310.12(c)) and Code Number None listed

Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standards (CFATS) Chemicals None listed

Superfund Amendments and Reauthorization Act (SARA)
SARA Section 311/312 Hazard Categories: Acute Health Hazard
SARA 313 Information: None of the components of this product are subject to reporting requirements of Section 313 of the Emergency Planning and Community Right-to Know Act of 1986.

SARA 302/304 Extremely Hazardous Substance: No components of the product exceed the threshold (de minimis) reporting levels established by these sections of Title III of SARA.

SARA 302/304 Emergency Planning & Notification: No components of the product exceed the threshold (de minimis) reporting levels established by these sections of Title III of SARA.

Comprehensive Response Compensation and Liability Act (CERCLA): This product contains no CERCLA reportable substances.

Clean Air Act (CAA)
This product does not contain any chemicals that are listed as Hazardous Air Pollutants (HAPs) designated in CAA Section 112 (b).
This product does not contain any Class 1 Ozone depletors.
This product does not contain any Class 2 Ozone depletors.

Clean Water Act (CWA)
None of the chemicals in this product are not listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

U.S. State Regulations
California Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986
None of the chemical(s) in this product are not known to the State of California to cause cancer, birth defects or other reproductive harm.

Other U.S. State Inventories
None of the components of this product are listed on any State Hazardous Substance Inventories, Right-to-Know lists and/or Air Quality/Air Pollutants lists.

Canada
WHMIS Hazard Symbol and Classification
D2B - Toxic materials causing other toxic effects - skin sensitization, skin and eye irritation in in animals

Canadian National Pollutant Release Inventory (NPRI): None of the chemicals in this product are listed on the NPRI.

European Economic Community
WGK, Germany (Water danger/protection): 1

Global Chemical Inventory Lists

<table>
<thead>
<tr>
<th>Country</th>
<th>Inventory Name</th>
<th>Inventory Listing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada:</td>
<td>Domestic Substance List (DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada:</td>
<td>Non-Domestic Substance List (NDSL)</td>
<td>No</td>
</tr>
<tr>
<td>Europe:</td>
<td>Inventory of New and Existing Chemicals (EINECS)</td>
<td>Yes</td>
</tr>
<tr>
<td>United States:</td>
<td>Toxic Substance Control Act (TSCA)</td>
<td>Yes</td>
</tr>
<tr>
<td>Australia:</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>Yes</td>
</tr>
<tr>
<td>New Zealand:</td>
<td>New Zealand Inventory of Chemicals (NZIoC)</td>
<td>Yes</td>
</tr>
<tr>
<td>China:</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Japan:</td>
<td>Inventory of Existing and New Chemical Substance (ENCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Korea:</td>
<td>Existing Chemicals List (ECL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines:</td>
<td>Philippines Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Yes - All components of this product are in compliance with the inventory requirements administered by the governing country.
No - One or more components of this product are not on the inventory or are exempt from listing.

15.2 Chemical safety assessment
For this product a chemical safety assessment was not carried out.
Hazardous Material Information System (HMIS)

HMIS Hazard Rating Legend
0 = Minimal  1 = Slight  2 = Moderate  3 = Serious
4 = Severe  * = Chronic Health Hazard

Health Flammability Physical Hazard Personal Protection

National Fire Protection Association (NFPA)

Flammability

Health Flammability Instability

NFPA Hazard Rating Legend
0 = Insignificant  1 = Slight  2 = Moderate
3 = High  4 = Extreme

Abbreviation Key
ACGIH American Conference of Governmental Industrial Hygienists
ADR Accord Dangereux Routier (European regulations concerning the international transport of dangerous goods by road)
CAS Chemical Abstract Services
CFR Code of Federal Regulations
DOT Department of Transportation
EMS Guide Emergency Response Procedures for Ships Carrying Dangerous Goods
EPA Environmental Protection Agency
ERG Emergency Response Guide Book
FDA Food and Drug Administration
GHS Globally Harmonized System of Classification and Labelling of Chemicals (GHS)
HCS Hazard Communication Standard
IARC International Agency for Research on Cancer
IATA International Air Transport Association half maximal
ICAO International Civil Aviation Organization
IDLH Immediately Dangerous to Life and Health
IMDG International Maritime Dangerous Goods
IMO International Maritime Organization
mppcf Millions of Particles Per Cubic Foot
NA North America
NIOSH National Institute for Occupational Safety
NTP National Toxicology Program
OSHA Occupational Safety and Health Administration
PBT Persistent, Bioaccumulating and Toxic
PEL Permissible exposure limit
PMCC Pensky-Martens Closed Cup
ppm Parts Per Million
RCRA Resource Conservation and Recovery Act
RID Dangerous Goods by Rail
RQ Reportable Quantity
TCC/Tag Tagliabue Closed Cup
TLV Threshold Limit Value
TSCA Toxic Substance Control Act
TWA Time-weighted Average
UN United Nations
VOC Volatile Organic Compounds
vPvB Very Persistent and Very Bioaccumulating
WHMIS Workplace Hazardous Materials Information System

DISCLAIMER OF RESPONSIBILITY

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Revision Date: 13 February 2017