CHEM-SOP-01	Revision #: 01	Implementation Date: 2020	Last Reviewed/ Update: 2020	Page #: 1 of 14

WORKING WITH SILICA

(CAS #: 7631-86-9, 112926-00-8)

NOTE: Refer to Appendix 3 for SDS (Safety Data Sheet) for Silica

Hazards:

Amorphous silica

- **Causes chronic bronchitis**
- **Causes chronic obstructive pulmonary disease**
- **May cause an allergic skin reaction**
- **May cause eye irritation**

Crystalline silica

- **Carcinogen to humans**
- **Causes silicosis**
- **Causes tuberculosis and other infections**
- **Causes chronic obstructive pulmonary disease**

To the best of our knowledge, the chemical, physical, and toxicological properties of amorphous silica have not been thoroughly investigated. Therefore, **amorphous silica should be handled as if possessing the same hazards as the crystalline form**. Silica gel may be harmful if inhaled, swallowed or absorbed through skin, as it may cause skin, eye and respiratory tract irritation.

In the LM-Chemistry Laboratories, the silica used is mainly constituent of 99% amorphous silica and no more than 1% crystalline silica.

*1. **Purpose:** to provide step by step guidance on how to safely work with silica.*

2. Scope: *applies to all students, staff, and faculty working with silica at the Lash Miller Laboratories. Individuals are responsible for knowing the details of this SOP as well as being familiar with the hazards posed by silica. Please refer to Appendix 3 of this SOP for the Safety Data Sheet (SDS).*

3. Prerequisites: *WHMIS, EHS101, LM-SST (hands on Lash Miller onboarding training). You must be trained by a competent person in your lab on the use of silica and understand the hazards. The specific training on the techniques and processes to be used must be documented.*

4. Responsibilities: *It is the responsibility of all faculty, staff and students to follow the procedures described in the SOP and sign the training-acknowledgement form (see Appendix 1). Lab personnel working with silica powder/silica gel are required to be provided with appropriate PPE, ensure compliance, and ensure safety training. Principal investigators are required to maintain accurate training records.*

5. Engineering Control: *Designate a Fume Hood (FH) for Silica work (see section 7 of this SOP). No work with silica powder/gel is allowed in the open lab.*

6. Personal Protective Equipment (PPE):

Required: Nitrile gloves, flame-resistant lab coats, safety goggles



During COVID19 pandemic, if physical distancing cannot be maintained while training others in the use of silica, trainer and trainee shall wear a flame-resistant, non-medical face mask

7. Handling Silica Gel (powder) Procedure:

IMPORTANT NOTICE:

The department has revised the practice of purchasing large 25 Kg pails and the practice of dispensing in the open (outside a FH) using snorkel ventilation systems to contain silica powder. Working together with EHS, the Department has determined that this practice is no longer acceptable due to the following reasons:

a. Snorkel's effectiveness cannot be certified (opposite to the case of FHs); therefore, the containment of particle dust of respirable size (< 10nm) cannot be ensured.

b. Dispensing/handling silica gel outside a FH requires users to be fit-tested and be provided with appropriate respirators.

Starting immediately (July-2020) all procedures handling silica powder must be done inside a designated, annually certified and operational FH.

PROCEDURE:

- Designate a FH for silica work by placing an appropriate sign (see Appendix 2 for an example).
- Bring silica stock inside the silica-designated FH whenever you need to work with it.
- Wear proper PPE.
- Contaminated work clothing (lab coats) should not be allowed out of the workplace and should be disposed of as solid chemical waste.
- Once work with silica is completed, wipe down area with a soap and water solution (always wet wipe down, never dry dusting).
- Silica should not be disposed down the drain. It should be collected and disposed of as chemical waste.
- Keep containers closed after dispensing procedures and maintain good housekeeping (FH surfaces, silica containers/lids, scales, etc.).
- Use in the smallest practical quantities for the experiment being performed.

For experimental protocols that could not be done inside a FH:

In some instances, when there is a justified reason for which a procedure involving silica powder cannot be done inside a FH, a risk assessment and pre-approval is required. Please contact Grace Flock to book a risk assessment: grace.flock@utoronto.ca

- If approved to work with silica outside a FH, lab personnel must be fit tested and provided with proper particulate filtering respirators and respirator's use training.
- Fit testing can be scheduled by contacting the EHS office (after approval was obtained): https://ehs.utoronto.ca/training/respiratory-protection-training-fit-testing/

- Respirators can be requested through Chem Stores, and all users must complete EHS532 Respiratory Protection Training prior to using respirators.
- Respirators will not be sold to those that were not fit tested and for procedures done in the open lab that were not pre-approved. Proof of fit test and completion of training will be requested by Stores as a pre-requisite for purchase of respirators.

8. Recommended Step-by-Step Generic Procedure for Preparing a Silica Gel Chromatography Column:

1) Before you start preparing your column, make a list of all the supplies you will require for your experiment set-up, including the scale and a waste container. This will be used to collect all waste materials to be disposed of into the appropriate chemical waste pail.
2) Don chemical-resistant gloves, flame-resistant lab coats and safety goggles. During COVID19, if needed, wear a non-medical, flame-resistant face mask if you need to train or receive training.
3) **All column preparation procedures are to be completed in the silica designated FH**.
4) Proceed to prepare the column by securing it in a vertical position. Put a clean flask under the column to collect any eluent that is drained during the preparation.
5) If required, apply a plug of cotton or glass wool to the bottom of the column and add sand.
6) Weigh out or dispense the desired amount of silica for your column.
7) Prepare the silica slurry by mixing the dry silica gel with the desired eluent in a flask.
8) Quickly but carefully pour the slurry into the column using a funnel. Stir and pour immediately to maximize the amount of silica that goes into the column instead of remaining behind in the flask. Any remaining silica can be mixed with more eluent and poured into the column.
9) Tap on the side of the column carefully to help the silica settle uniformly.
10) Pour more solvent on top to rinse any silica that is sticking to the sides of the column. Allow the silica to settle while the eluent continues to drip into the flask.
11) Once the silica has settled, add the sand and sample to the column and proceed to run your column chromatography experiment as required by your procedure. If desired, connect an adaptor and apply air pressure.
12) Dispose the silica gel into a waste container after the procedure.
13) Place the container containing the waste in a 20L green chemical waste pail as provided by EPS.
14) Remove your gloves and dispose them in the chemical waste pail.
15) Thoroughly wash hands after handling.
16) Ensure you leave the FH clean (use wet wiping) and remove the silica gel stocks. Wet wipe the outside of silica stock containers before removing from the FH. Never use a dustpan and broom to clean silica.

Appendix 1:

Silica Work-Training-Acknowledgment Form

This form is to be completed by the employee/student intending to work with silica.

I have read the "Working with Silica Procedure". I understand the hazards of working with Silica and how to minimize the risks by following the safe work procedures and wearing appropriate PPE at all times.

□ YES □ NO

PRINT NAME & LAST NAME	SIGNATURE	DATE

Appendix 2:

Silica Work Area Sign

This sign is to be labeled on the chosen FH to indicate that silica work is done in that FH.

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SAFETY DATA SHEET

Version 6.0
Revision Date 04.05.2019
Print Date 30.09.2020

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Silica gel

Product Number : 717185
Brand : Aldrich
CAS-No. : 112926-00-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : SIGMA-ALDRICH CANADA CO.
2149 WINSTON PARK DRIVE
OAKVILLE ON L6H 6J8
CANADA

Telephone : +1 905 829-9500
Fax : +1 905 829-9292

1.4 Emergency telephone number

Emergency Phone # : 800-424-9300 CHEMTREC (USA)
+1-703-527-3887 CHEMTREC (International)
24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : SiO_2
CAS-No. : 112926-00-8
EC-No. : 231-545-4

Component	Classification	Concentration *
Silica-Amorphous, precipitated		
		<= 100 %
* Weight percent		

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact
Wash off with soap and plenty of water.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
silicon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas.
For personal protection see section 8.

6.2 Environmental precautions
No special environmental precautions required.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place. Hygroscopic.
Storage class (TRGS 510): 13: Non Combustible Solids

7.3 Specific end use(s)
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
Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Silica-Amorphous, precipitated	112926-00-8	TWAEV	10 mg/m3	Canada. Ontario OELs
		TWAEV	6 mg/m3	Québec. Regulation respecting occupational health and safety, Schedule 1, Part 1: Permissible exposure values for airborne contaminants
Remarks	The standard corresponds to dust containing no asbestos and the percentage in crystalline silica is less than 1 %.			
		TWAEV	6 mg/m3	Québec. Regulation respecting occupational health and safety, Schedule 1, Part 1: Permissible exposure values for airborne contaminants
	The standard corresponds to dust containing no asbestos and the percentage in crystalline silica is less than 1 %.			
		TWA	1.5 mg/m3	Canada. British Columbia OEL

		TWA	4 mg/m3	Canada. British Columbia OEL

8.2 Exposure controls

Appropriate engineering controls
General industrial hygiene practice.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
No special environmental precautions required.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: white
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - silicon oxides
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
No data available
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: VV7315000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Amorphous silica is not classifiable as to its carcinogenicity to humans (Group 3); however, crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1, IARC). Therefore, amorphous silica should be handled as

if possessing the same hazards as the crystalline form., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

SECTION 15: Regulatory information

This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (HPR) and the SDS contains all the information required by the HPR.

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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