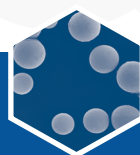


SOLUTIONS FOR CHROMATOGRAPHY,
PURIFICATION, AND SYNTHESIS





Founded in 1995, SiliCycle is specialized in the development, manufacturing and commercialization of high value silica gels and specialty products for chromatography, purification and synthesis.

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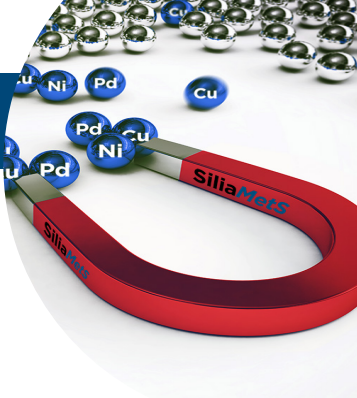
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SiliaMetS and SiliaBond – Scavenging

- Broadest portfolio of scavengers with associated applications
- Green and environmentally friendly technology
- Great variety of formats for all purifications scales: from laboratory to plant scale
- Compatible with various experimental conditions, solvents, pH and temperatures



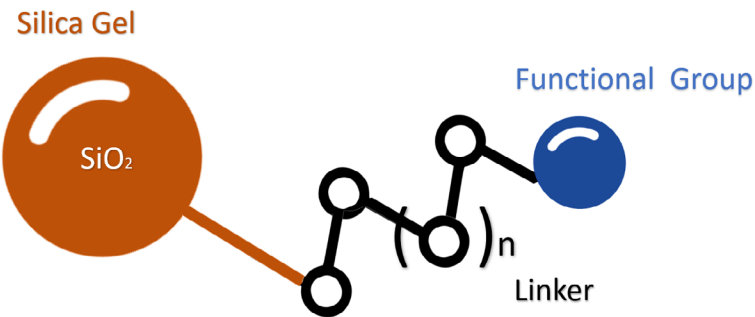
SiliaMetS and SiliaBond Silica-Based Scavengers

Chemists have been searching for techniques and tools to separate, isolate and purify chemical substances from one another to improve the quality of the synthesized molecules. SiliCycle scavenging technologies enables powerful purification processes to help reach new purity standards.

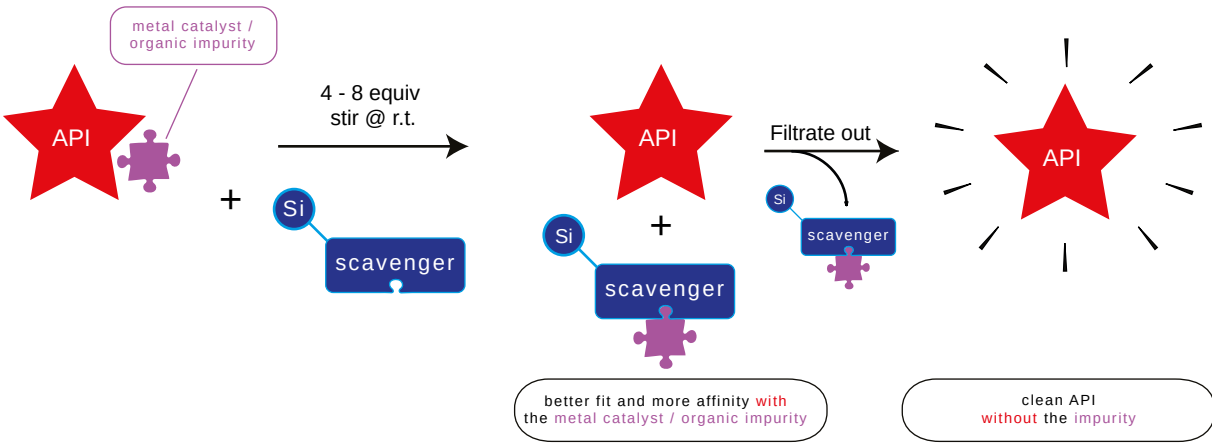
Silica-based scavengers have been proven to be the most effective method for removing metal or organic impurities without contaminating drug candidates. A silica matrix offers many advantages over polymers:

- Reduced purification steps
- No swelling
- More general solvent compatibility
- Higher mechanical and thermal stabilities
- Easily scalable applications
- Availability in different product formats, such as bulk, E-PAK flow cartridges, SPE or flash cartridges, etc.

Typical structure of our functionalized silicas with various organic groups



What makes SiliaMetS metal scavengers and SiliaBond organic scavengers so easy to use is their heterogeneous nature. When used in bulk in a contaminated solution, all you need to do is filter off the scavenger with the bound impurity and dispose of it.



When used in SPE or flash cartridges for batch reactions, the filtration process – with adapted experimental conditions – will leave the contaminant in the cartridge, rendering the solution free of impurities.

Scavengers in E-PAK Flow Cartridges

E-PAK is a family of radial flow adsorption cartridges developed specifically for pharmaceutical processings.

Created with proprietary technology, E-PAK cartridges provide rapid adsorption kinetics at flow rates and processing capacities suitable for laboratory, pilot and commercial operations. They are designed for use with both organic and aqueous solvents, and incorporate design features useful for the production of active pharmaceutical ingredients (API).

Features and Benefits

- Proven cartridge design ensures rapid, simple and reliable technology
- High adsorption capacity and flow rate
- Fixed-bed design ensuring safer handling, clean-up and disposal
- Large adsorbent capacity in small area footprint increases product recovery and reduces solvent requirements

Sorbents for E-PAK Cartridges

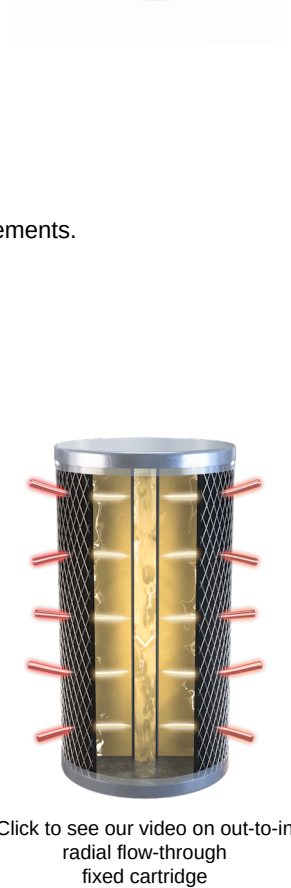
E-PAK cartridges are available in a range of sorbents to accommodate the broad range of processing requirements. Other adsorbents are available under request.

Sorbents for E-PAK		
Active Adsorbents (typical loading)	For Removal and/or Recovery of:	pH Operation
Silia MetS Thiol (1.2 mmol/g)	Pd, Ag, Hg, Os, Ru, Cu, Ir, Pb, Rh, Se & Sn	2 to 9
Silia MetS DMT (0.5 mmol/g)	Pd, As, Ir, Ni, Os, Pt, Rh, Ru, Se, Cd, Co, Cu, Fe, Sc & Zn	
Silia MetS Imidazole (0.96 mmol/g)	Cd, Co, Cu, Fe, Ir, Li, Mg, Ni, Os, W, Zn, Cr, Pd & Rh	
Silia MetS AMPA (0.8 mmol/g)	Al, Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Mn, Nd, Ni, Pm, Pr, Sb, Sn, Tb, Tm, V, Yb, Co, Cu, Fe, Mg & Zn	
Silia Bond Amine (1.2 mmol/g)	Pd, Cr, Pt, W, Zn, Cd, Co, Cu, Fe, Hg, Ni, Pb, Ru, Sc & Se	
Silia MetS Diamine (1.28 mmol/g)		
Silia MetS Triamine (1.11 mmol/g)		
Silia MetS TAAcONa (0.41 mmol/g)	Ca, Cd, Cs, Cu, Fe, Ir, La, Li, Mg, Ni, Os, Rh, Sc, Sn, Cr, Pd, Ru, Se & Zn	1 to 13
Silia Bond Cyano (1.38 mmol/g) and Florisil	Various organic molecules	
Silia Bond Propylsulfonic Acid SCX-2 (0.63 mmol/g)	Amines and anilines, ion exchange	
Silia Flash Bare Silica	Very vast range of organic impurities, metals, pigments, etc.	
Activated Carbon Silia Carb CA	Precious metal catalysts and colors	
Activated Carbon Silia Carb HA		
Activated Carbon Silia Carb VA		
Activated Carbon Silia Carb VW		

Best scavenger is indicated in Navy Blue while good scavenger is indicated in Pale Blue.

E-PAK cartridges are manufactured using a proprietary technology and chemically stable materials in most common organic solvents. They have been tested and found satisfactory for use with the following commonly used solvents:

- 2-Butanone
 - Dichloromethane
 - Ethanol
 - Ethyl acetate
 - Heptane
- Methanol
 - MTBE
 - N-ethyl-2-pyrrolidone
 - Tetrahydrofuran (at room temperature)
 - Toluene (at room temperature)



Click to see our video on out-to-in radial flow-through fixed cartridge

Lab Scale

Lab scale cartridges are designed to facilitate small samples evaluation. Testing with loose media can be done with samples as small as a few milliliters and is normally done before cartridge testing to identify the formula with the highest capacity to remove contaminants with the highest recovery.

Lab Scale Cartridges				
Cartridge Size Diameter × Height (cm)	Typical Flow Rate Range (mL/min)	Pressure Drop with w/1 cP Fluid (psig)	Media Weight (g)	
			SiliaFlash, SiliaMetS and SiliaBond	SiliaCarb
5 × 1	1 - 20	≤ 5	8	5
5 × 10	10 - 200	≤ 5	75	50
5 × 25	25 - 500	≤ 5	200	125

Note: Faster flow rates can be used for the lab scale cartridges depending on the application or the scavenging difficulty (1 cm up to 100 mL/min, 10 cm up to 500 mL/min and 25 cm up to 1 L/min).

Pilot and Commercial Scale

E-PAK pilot scale cartridges provide rapid processing for volumes from 10 to hundreds of liters, and can establish the parameters upon moving to larger scales, since E-PAK achieve true linear scalability.

E-PAK commercial scale cartridges provide rapid processing for manufacturing operations needing to process batch sizes of > 10,000 liters or can be adapted for continuous operation using a duplex design.

Pilot and Commercial Scale Cartridges				
Cartridge Size Diameter × Height (cm)	Typical Flow Rate Range (L/min)	Pressure Drop with w/1 cps Fluid (psig)	Media Weight (kg)	
			SiliaFlash, SiliaMetS and SiliaBond	SiliaCarb
Pilot Scale				
16.5 × 12.5	0.10 - 2.5	≤ 10	0.87	0.55
16.5 × 25	0.25 - 5	≤ 10	1.75	1.10
Commercial Scale				
16.5 × 50	0.50 - 10	≤ 10	3.50	2.10
16.5 × 100	1 - 20	≤ 10	7.00	4.10

Both pilot and commercial cartridges are provided with a Code 8 (closed top & open bottom end caps-bottom with double 2-222 Teflon® encapsulated Viton® o-ring) cartridge sealing configuration. To meet commercial processing requirements, E-PAK cartridges can be operated in parallel for increased capacity.

Housings

Lab Scale

- Various housing length available (for 1 cm, 10 cm, and 25 cm cartridges)
- Made in stainless steel 316L or Hastelloy C276
- Pressure rating for housing 150 psi (10 bar)
- Easy housing conversion for all lengths by changing the bowl
- Operated with standard pump, low pressure and peristaltic



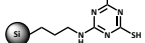



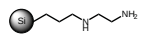

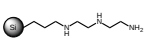

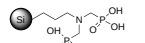



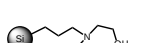



Pilot and Commercial Scale

- Various housings available for simultaneous operation of 1 to 12 cartridges (for 12.5 cm, 25 cm, 50 cm, and 100 cm)
- Made in stainless steel 316L or Hastelloy C276
- Pressure rating for housing 150 psi (10 bar)
- Can be operated in parallel to process batch sizes of ≥ 1,000 L
- ASME and PED 2014/68/EU, CE compliant

Click to watch our video: from lab to commercial scale E-PAK housings

SiliaMetS Metal Scavengers Portfolio

SiliaMetS Metal Scavengers Technical Information				
Scavengers	Structure	Brief Description	Metals Removed ¹	Typical Characteristics ^{2,3}
<div><div>PGI-S</div><div>SiliaMetS Thiol PN: R51030B Loading: ≥ 1.20 mmol/g Endcapping: Yes</div></div>		SiliaMetS Thiol is our most versatile and robust metal scavenger for a variety of metals under a wide range of conditions.	Ag, Au, Hg, Os, Pd & Ru Cu, Ir, Pb, Rh & Sn	Color: White Density: 0.682 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div>PGI-S</div><div>SiliaMetS DMT PN: R79030B Loading: ≥ 0.50 mmol/g Endcapping: Yes</div></div>		SiliaMetS DMT is the silica-bound equivalent of 2,4,6-trimercaptotriazine (<i>trithiocyanuric acid, TMT</i>). It is a versatile metal scavenger for a variety of metals and the preferred metal scavenger for ruthenium catalysts and hindered Pd complexes (<i>i.e. Pd(dppf)Cl₂</i>).	Au, Ir, Ni, Os, Pd, Pt, Re, Rh & Ru Cd, Co, Cu, Fe, Sc & Zn	Color: Light brown Density: 0.732 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div></div><div>SiliaBond Amine PN: R52030B Loading: ≥ 1.20 mmol/g Endcapping: Yes</div></div>		Also known for their electrophile scavenging efficiencies and their base reagent qualities, SiliaMetS Amine, Diamine and Triamine have also proven to be very useful for the scavenging of the following metals: Pd, Pt, Cr, W and Zn.	Cd, Cr, Pd, Pt, Rh, Re & Ru Co, Cu, Fe, Hg, Pb, W & Zn	Color: Off-white Density: 0.700 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
<div><div></div><div>SiliaMetS Diamine PN: R49030B Loading: ≥ 1.28 mmol/g Endcapping: Yes</div></div>			Cr, Pd, Pt, W & Zn Cd, Co, Cu, Fe, Hg, Ni, Pb, Ru, V & Sc	Color: Off-white Density: 0.728 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
<div><div>PGI-S</div><div>SiliaMetS Triamine PN: R48030B Loading: ≥ 1.11 mmol/g Endcapping: Yes</div></div>			Cr, Pd, Pt, W & Zn Ag, Cd, Co, Cu, Fe, Hg, Ni, Os, Pb, Rh, Ru & Sc	Color: Off-white Density: 0.736 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
<div><div></div><div>SiliaMetS AMPA PN: R85130B Loading: ≥ 0.80 mmol/g Endcapping: Yes</div></div>		SiliaMetS AMPA is an aminomethyl-alkylphosphonic acid ligand known for its excellent metal-bonding properties. It is particularly efficient to remove Al, Sb, Ni, La, and also very effective for Co, Cu, Fe, Mg and Zn scavenging from reaction intermediates or final APIs.	Al, Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Mg, Mn, Nd, Ni, Pm, Pr, Sb, Sm, Tb, Tm, V, Yb & Zr Co, Cu, Fe, Mg & Zn	Color: Yellow Density: 0.707 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 1 Year 
<div><div></div><div>SiliaMetS Cysteine PN: R80530B Loading: ≥ 0.30 mmol/g Endcapping: Yes</div></div>		SiliaMetS Cysteine is the silica-bound equivalent of the amino acid cysteine. It is a versatile scavenger for a variety of metals and the preferred metal scavenger for tin residues. By attaching the molecule to the backbone via the amino group, the thiol group remains free and accessible for higher metal scavenging efficiency.	Au, Cd, Fe, Ir, Os, Ru, Sc & Sn Ca, Cr, Cs, Cu, La, Mg, Pd, Pt, Rh & Zn	Color: Orange Density: 0.665 g/mL Solvent Compatibility: 1 <i>(although we recommend organic solvent when possible)</i> Prolonged Storage: 1 Shelf Life: 1 Year 
<div><div>PGI-S</div><div>SiliaMetS DEAM PN: R54430B Loading: ≥ 0.85 mmol/g Endcapping: Yes</div></div>		SiliaMetS DEAM is a versatile scavenger designed to remove trace metal of Ti, Zn, Fe and Ag as well as boronic acids from reaction intermediates or final APIs.	Ag, Au, Fe, Sn, Ti, Zn & Zr	Color: Off-white Density: 0.691 g/mL Solvent Compatibility: 1 Prolonged Storage: 2 Shelf Life: 2 Years 

¹ **Scavenging Efficiency:**

- Best scavenger for the removal of a particular metal is indicated in **Navy Blue**
- Good scavenger indicated in **Pale Blue**

² **Solvent Compatibility:**

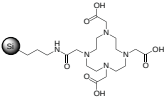

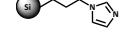

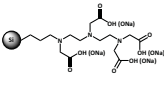


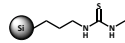

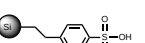

- 1- All solvents, aqueous and organic
- 2- All organic solvents

³ **Prolonged Storage:**

- 1- Keep dry
- 2- Keep cool (< 8°C) and dry
- 3- Keep cool (< 8°C), dry and under inert atmosphere

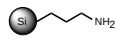

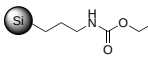

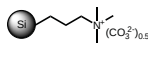


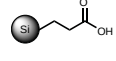

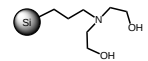

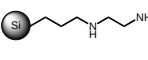

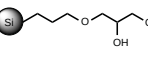

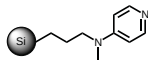

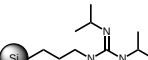




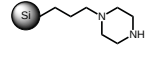


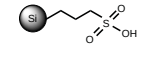


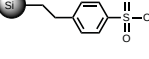

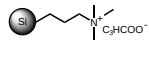

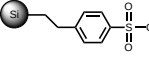


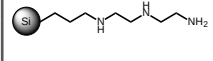

Potentially Genotoxic Impurities (PGI) Scavenger

SiliaMetS Metal Scavengers Technical Information				
Scavengers	Structure	Brief Description	Metals Removed ¹	Typical Characteristics ^{2,3}
<div><div>PGI-S</div><div>SiliaMetS DOTA PN: R91030B Loading: ≥ 0.38 mmol/g Endcapping: Yes</div></div>		SiliaMetS DOTA is a silica-supported tetracarboxylic acid and its various conjugate bases. DOTA molecule is a well-adopted complexing agent. Linked to various metals, so formed-complexes are used as contrast agents in cancer treatments or other medical applications.	Ca, Cu, Gd, La, Ni & Zn Co, Fe, Mg, Pd, Pt & Rh	Color: Light yellow Density: 0.681 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 1 Year 
<div><div></div><div>SiliaMetS Imidazole PN: R79230B Loading: ≥ 0.96 mmol/g Endcapping: Yes</div></div>		SiliaMetS Imidazole is a versatile metal scavenger for a variety of metals including Cd, Co, Cu, Fe, Ni, Os, Pd and Rh.	Cd, Co, Cu, Fe, Ir, Li, Mg, Ni, Os, W & Zn Cr, Pd & Rh	Color: Off-white Density: 0.681 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div>PGI-S</div><div>SiliaMetS TAAcOH PN: R69030B Loading: ≥ 0.41 mmol/g Endcapping: No</div></div>		SiliaMetS TAAcOH & TAAcONa are supported versions of EDTA in their acid and sodium salt forms. These two products are effective metal scavengers for Ca, Mg, Li, Ir, Cs, Os, Sn, Pd, Ni and Cu.	Au, Ca, Co, Ir, Li, Mg, Ni, Os, Ru & Sc Cr, Cs, Fe, Pd, Rh & Sn	Color: Off-white Density: 0.635 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div></div><div>SiliaMetS TAAcONa PN: R69230B Loading: ≥ 0.41 mmol/g Endcapping: No</div></div>			Ca, Cd, Cs, Cu, Fe, Ir, La, Li, Mg, Ni, Os, Rh, Sc & Sn Cr, Pd, Ru & Zn	Color: Off-white Density: 0.712 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div></div><div>SiliaMetS Thiourea PN: R69530B Loading: ≥ 1.07 mmol/g Endcapping: Yes</div></div>		SiliaMetS Thiourea is a versatile metal scavenger for all forms of palladium and is widely used in the pharmaceutical industry. Once complexed with a transition metal, it has been reported to be an effective catalyst.	Au, Pd & Ru Ag, Cu, Fe, Os, Rh, Sc & Sn	Color: Off-white Density: 0.767 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
<div><div>PGI-S</div><div>SiliaBond Tosic Acid PN: R60530B Capacity: ≥ 0.54 meq/g Endcapping: Yes</div></div>		SiliaBond Tosic Acid is in a class of strong acids used in different fields of synthetic organic chemistry. The aromatic ring makes it slightly more acidic than other supported sulfonic acids.	Fe, Rh & Sn Ag, Cu, Ni, Pd, Pt, Ru & Zn	Color: Off-white Density: 0.698 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years 


E-PAK Cartridges Portfolio							
Type	Laboratory Scale - 5 cm diameter			Pilot Scale - 16.5 cm diameter		Commercial Scale - 16.5 cm diameter	
	1 cm	10 cm	25 cm	12.5 cm	25 cm	50 cm	100 cm
SiliaFlash Irregular Silica Gel							
40 - 63 µm	LS-R10030B-51	LS-R10030B-510	LS-R10030B-525	PS-R10030B-1612	PS-R10030B-1625	CS-R10030B-1650	CS-R10030B-16100
60 - 200 µm	LS-R10040B-51	LS-R10040B-510	LS-R10040B-525	PS-R10040B-1612	PS-R10040B-1625	CS-R10040B-1650	CS-R10040B-16100
SiliaMetS Metal Scavenger							
Thiol	LS-R51030B-51	LS-R51030B-510	LS-R51030B-525	PS-R51030B-1612	PS-R51030B-1625	CS-R51030B-1650	CS-R51030B-16100
DMT	LS-R79030B-51	LS-R79030B-510	LS-R79030B-525	PS-R79030B-1612	PS-R79030B-1625	CS-R79030B-1650	CS-R79030B-16100
Imidazole	LS-R79230B-51	LS-R79230B-510	LS-R79230B-525	PS-R79230B-1612	PS-R79230B-1625	CS-R79230B-1650	CS-R79230B-16100
AMPA	LS-R85130B-51	LS-R85130B-510	LS-R85130B-525	PS-R85130B-1612	PS-R85130B-1625	CS-R85130B-1650	CS-R85130B-16100
Amine	LS-R52030B-51	LS-R52030B-510	LS-R52030B-525	PS-R52030B-1612	PS-R52030B-1625	CS-R52030B-1650	CS-R52030B-16100
Diamine	LS-R49030B-51	LS-R49030B-510	LS-R49030B-525	PS-R49030B-1612	PS-R49030B-1625	CS-R49030B-1650	CS-R49030B-16100
Triamine	LS-R48030B-51	LS-R48030B-510	LS-R48030B-525	PS-R48030B-1612	PS-R48030B-1625	CS-R48030B-1650	CS-R48030B-16100
TAAcONa	LS-R69230B-51	LS-R69230B-510	LS-R69230B-525	PS-R69230B-1612	PS-R69230B-1625	CS-R69230B-1650	CS-R69230B-16100
Cyano	LS-R38030B-51	LS-R38030B-510	LS-R38030B-525	PS-R38030B-1612	PS-R38030B-1625	CS-R38030B-1650	CS-R38030B-16100
SCX-2	LS-R51230B-51	LS-R51230B-510	LS-R51230B-525	PS-R51230B-1612	PS-R51230B-1625	CS-R51230B-1650	CS-R51230B-16100
SiliaCarb Activated Carbon							
CA	LS-CCA-51	LS-CCA-510	LS-CCA-525	PS-CCA-1612	PS-CCA-1625	CS-CCA-1650	CS-CCA-16100
HA	LS-CHA-51	LS-CHA-510	LS-CHA-525	PS-CHA-1612	PS-CHA-1625	CS-CHA-1650	CS-CHA-16100
VA	LS-CVA-51	LS-CVA-510	LS-CVA-525	PS-CVA-1612	PS-CVA-1625	CS-CVA-1650	CS-CVA-16100
VW	LS-CVW-51	LS-CVW-510	LS-CVW-525	PS-CVW-1612	PS-CVW-1625	CS-CVW-1650	CS-CVW-16100

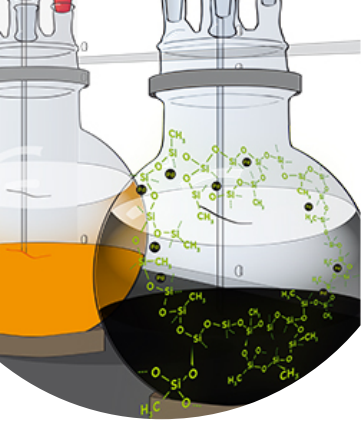
SiliaBond Organic Scavengers Portfolio

SiliaBond Organic Scavengers Technical Information				
Scavengers	Structure	Nature	Molecules Removed	Typical Characteristics ^{1, 2}
SiliaBond Amine PN: R52030B Loading: ≥ 1.20 mmol/g Endcapping: Yes		Scavenger for Electrophiles (Covalent Bonding)	Acyl Chlorides, Aldehydes, Anhydrides, Chloroformates, Isocyanates, Ketones & Sulfonyl Chlorides	Color: Off-white Density: 0.700 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
		Scavenger for Acids (Ionic Bonding) Catch and Release	Acids & Acidic Phenols	
SiliaBond Carbamate PN: R50130B Loading: ≥ 1.16 mmol/g Endcapping: Yes		Scavenger for Nucleophiles (Covalent Bonding)	Alcohols, Alkoxides, Amines, Anilines, Hydrazines, Organometallics, Thiols & Thiolates	Color: Off-white Density: 0.741 g/mL Solvent Compatibility: 3 Prolonged Storage: 2 Shelf Life: 2 Years 
SiliaBond Carbonate PN: R66030B Loading: ≥ 0.46 mmol/g Endcapping: Yes		Scavenger for Acids (Ionic Bonding) Catch and Release	Acids, Acidic Phenols & Boronic Acids	Color: Off-white Density: 0.608 g/mL Solvent Compatibility: 3 Prolonged Storage: 1 Shelf Life: 1 Years 
 SiliaBond Carboxylic Acid PN: R70030B Loading: ≥ 0.92 mmol/g Endcapping: Yes		Scavenger for Bases (Ionic Bonding) Catch and Release	Primary / Secondary Amines & Anilines	Color: Off-white Density: 0.687 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
SiliaMetS DEAM PN: R54430B Loading: ≥ 0.85 mmol/g Endcapping: Yes		Scavenger for Electrophiles & Lewis Acids (Covalent and Ionic Bonding) Catch and Release	Boronic Acids	Color: Off-white Density: 0.691 g/mL Solvent Compatibility: 1 Prolonged Storage: 2 Shelf Life: 2 Years 
SiliaMetS Diamine PN: R49030B Loading: ≥ 1.28 mmol/g Endcapping: Yes		Scavenger for Electrophiles (Covalent Bonding)	Acyl Chlorides, Aldehydes, Anhydrides, Chloroformates, Isocyanates, Ketones & Sulfonyl Chlorides	Color: Off-white Density: 0.728 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
		Scavenger for Acids (Ionic Bonding) Catch & Release	Acids & Acidic phenols	
SiliaBond Diol PN: R35030B Loading: ≥ 0.97 mmol/g Endcapping: No		Scavenger for Electrophiles & Lewis Acids (Covalent and Ionic Bonding) Catch and Release	Boronic Acids	Color: Off-white Density: 0.687 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years 
SiliaBond DMAP PN: R75630B Loading: ≥ 0.53 mmol/g Endcapping: Yes		Scavenger for Electrophiles (Covalent Bonding)	Acyl Chlorides & Sulfonyl Chlorides	Color: Light brown to brown Density: 0.674 g/mL Solvent Compatibility: 1 Prolonged Storage: 3 Shelf Life: 1 Years 
SiliaBond Guanidine PN: R68230B Loading: ≥ 0.80 mmol/g Endcapping: Yes		Scavenger for Acids (Ionic Bonding) Catch and Release	Acids, Acidic Phenols & Boronic Acids	Color: Light yellow Density: 0.732 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 

SiliaBond Organic Scavengers Technical Information				
Scavengers	Structure	Nature	Molecules Removed	Typical Characteristics ^{1, 2}
 SiliaBond Piperazine PN: R60030B Loading: ≥ 0.83 mmol/g Endcapping: Yes		Scavenger for Electrophiles (Covalent Bonding)	Acyl Chlorides, Aldehydes, Anhydrides, Chloroformates, Isocyanates, Ketones & Sulfonyl Chlorides	Color: Off-white Density: 0.671 g/mL Solvent Compatibility: 1 Prolonged Storage: 2 Shelf Life: 2 Years 
		Scavenger for Acids (Ionic Bonding) Catch and Release	Acids & Acidic Phenols	
 SiliaBond Propylsulfonic Acid PN: R51230B Loading: ≥ 0.63 mmol/g Endcapping: Yes		Scavenger for Bases (Ionic Bonding)	Amines & Anilines	Color: Off-white Density: 0.728 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
 SiliaBond Tosic Acid PN: R60530B Loading: ≥ 0.54 meq/g Endcapping: Yes		Catch and Release		Color: Off-white Density: 0.698 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years 
SiliaBond TMA Acetate PN: R66430B Loading: ≥ 0.71 mmol/g Endcapping: No		Scavenger for Acids (Ionic Bonding) Catch and Release	Carboxylic Acids	Color: Off-white Density: 0.665 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years 
SiliaBond Tosyl Chloride PN: R44030B Loading: ≥ 0.63 mmol/g Endcapping: Yes		Scavenger for Nucleophiles (Covalent Bonding)	Alcohols, Alkoxides, Amines, Anilines, Hydrazines, Organometallics, Thiols & Thiolates	Color: Off-white Density: 0.761 g/mL Solvent Compatibility: 4 Prolonged Storage: 3 Shelf Life: 6 months 
 SiliaMetS Triamine PN: R48030B Loading: ≥ 1.11 mmol/g Endcapping: Yes		Scavenger for Electrophiles (Covalent Bonding)	Acyl Chlorides, Aldehydes, Anhydrides, Chloroformates, Isocyanates, Ketones & Sulfonyl Chlorides	Color: Off-white Density: 0.736 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years 
		Scavenger for Acids (Ionic Bonding) Catch and Release	Acids & Acidic Phenols	

- ¹ **Solvent Compatibility:**
- 1- All solvents, aqueous and organic
 - 2- All organic solvents
 - 3- Anhydrous aprotic solvents
 - 4- Anhydrous aprotic solvents, unstable in DMF
 - 5- Polar solvents (DMF, MeOH, H₂O)
- ² **Prolonged Storage:**
- 1- Keep dry
 - 2- Keep cool (< 8°C) and dry
 - 3- Keep cool (< 8°C), dry and under inert atmosphere

 Potentially Genotoxic Impurities (PGI) Scavenger



SiliaBond and SiliaCat – Organic Synthesis

- Easy product / API isolation and purification
- Eliminates or strongly reduces the need for laborious purifications
- Suitable for either batch or continuous flow applications
- Compares very favorably to polymer-based: no swelling, thermally and mechanically stable, and compatible with all solvents

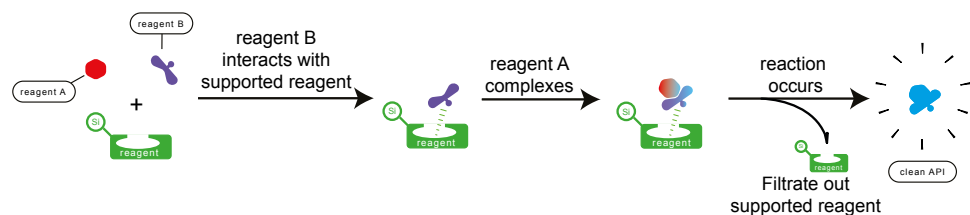
SiliaBond Silica-Based Reagents and Oxidants

Increasingly, the use of heterogeneous reagents in organic synthesis and chemical production is growing in importance.

Although the strength of this technology has been acknowledged for a long time for applications in a large number of diverse and interesting chemical reactions – thanks to its efficiency and eco-friendly character – the number of available reagents has lagged behind. At this time, SiliCycle has developed the most complete offer of heterogeneous reagents and oxidants.

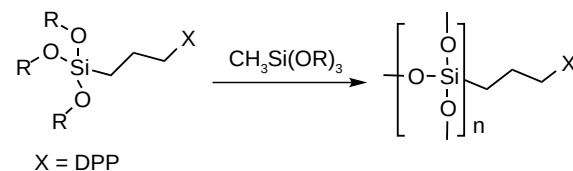
This technology is completely in line with the industries seeking improved sustainability and reduced ecological footprint. This strong trend is directly derived from the inherent benefits offered by silica-based heterogeneous reagents and oxidants stated herein.

Here is the reaction mechanism:



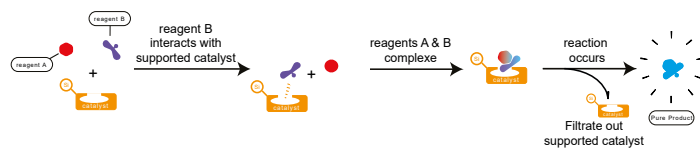
SiliaCat Heterogeneous Catalysts

Inspired by the ORganically MODified SiLica (ORMOSIL) technology, the SiliaCat family is composed of new and innovative catalysts. Resulting from the co-condensation of two organosilane monomers by the sol-gel process, the hybrid organic-inorganic materials present the highest stability and reactivity available with heterogeneous catalysts. Furthermore, the highly cross-linked framework presents a better resistance compared to post-functionalization process.



What is SiliaCat Heterogeneous Catalyst?

Usually, heterogeneous catalysts supported on a silica matrix are immobilized by post-modification of the inorganic support. These supports, however, present a high degree of leaching due to the poor stability of the immobilized phase. For example, with SiliaCat the ligand is directly cross-linked in an organic-inorganic framework. This results in a high degree of stability of the catalysts. Compared to homogeneous catalysts, SiliaCat exhibits a similar reactivity and selectivity with one of the major advantages being that the catalyst is eliminated from the reaction mixture by a simple filtration. Forget your purification problems with our SiliaCat catalysts family.



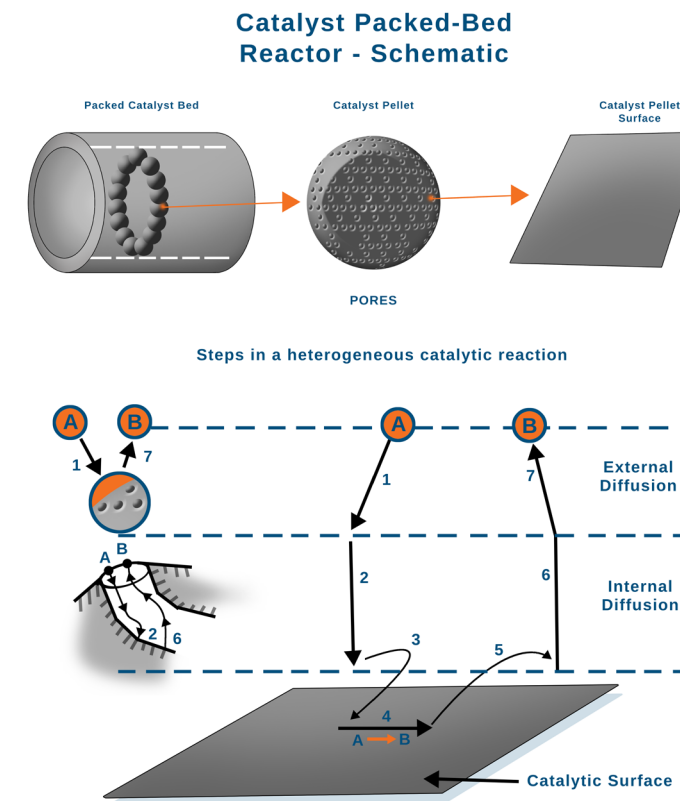
Heterogeneous Catalytic Reaction Basics

To maximize reaction rate on a porous catalyst, it is essential to maximize accessibility of all reactants to the active catalytic sites, which are dispersed through the internal pore structure of the catalyst.

Imagine a reactant **A** flowing through a bulk liquid and a bed of a heterogeneous catalyst reacting on the catalytic surface to form a species **B**.

Schemes at right present the physical and chemical steps that must occur for **A** to convert to **B**:

1. Mass transfer (*diffusion*) of the reactant(s) (e.g. species **A**) from the bulk liquid and a separate liquid film surrounding each suspended catalyst particle to the external surface of the catalyst particle.
2. Diffusion of the reactant from the pore mouth through the catalyst pores to the immediate vicinity of the internal catalytic surface.
3. Adsorption of reactant **A** onto the catalyst surface.
4. Reaction on the surface of the catalyst (e.g. $A \rightarrow B$).
5. Desorption of the products (e.g. **B**) from the surface.
6. Diffusion of the products from the interior of the pellet to the pore mouth at the external surface.
7. Mass transfer of the products from the external pellet surface to the bulk fluid.



Different Formats for Different Applications

Please refer to our Ordering Information Section to learn more about all formats available and the corresponding part numbers.

Catalysts, Reagents, and Oxidants as Bulk Silica

All our products can be used in bulk directly in your reaction flask or reactor and are available from 5 g to 25 kg formats, up to multi-ton scale.



Reagents and Oxidants in SiliaPrep SPE and SiliaSep Flash Cartridges

Almost all our reagents and oxidants are available in pre-packed cartridges.

- **SiliaPrep SPE cartridges**
From 3 mL / 200 mg to 12 mL / 2 g
- **SiliaSep OT (Open Top) flash cartridges**
From 25 mL / 5 g to 150 mL / 70 g
- **SiliaSep flash cartridges**
From 4 g to 1.6 kg bed weight



SiliaBond and SiliaCat Portfolio

SiliaBond Reagents and Oxidants / SiliaCat Heterogeneous Catalysts Technical Information				
Products	Structure	Brief Description	Typical Reactions	Typical Characteristics ^{a, b}
SiliaBond Amine PN: R52030B Loading: ≥ 1.20 mmol/g Endcapping: Yes		Used as an effective catalyst for Knoevenagel reactions as well as a support in solid-phase chemistry for peptide synthesis followed by enzymatic hydrolysis and for Claisen rearrangement.	Knoevenagel reactions Peptide synthesis Claisen rearrangement	Color: Off-white Density: 0.700 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years
SiliaBond Carbodiimide PN: R70530B Loading: ≥ 0.91 mmol/g Endcapping: Yes		Most commonly used reagent in peptide synthesis and other amide bond-forming reactions of primary and secondary amines with carboxylic acids.	Amide coupling with acids, acyl chlorides and amines	Color: Orange Density: 0.751 g/mL Solvent Compatibility: 3 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond Carbonate PN: R66030B Loading: ≥ 0.46 mmol/g Endcapping: Yes		Used as a heterogeneous catalyst in the Henry reaction in catalytic amounts drive the reaction forward to high yield with or without solvent.	Nitro-Aldol reactions (<i>Henry reaction</i>), free basing of amine	Color: Off-white Density: 0.608 g/mL Solvent Compatibility: 3 Prolonged Storage: 1 Shelf Life: 1 Year
SiliaBond Carboxylic Acid PN: R70030B Loading: ≥ 0.92 mmol/g Endcapping: Yes		Acid used as a scavenger for amines or carbonates, and for the quench of alkoxides and organometallic reagents.	Acid used to quench of alkoxides and organometallic reagents	Color: Off-white Density: 0.687 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond Cyanoborohydride PN: R66730B Loading: ≥ 0.87 mmol/g Endcapping: Yes		Used in reductive amination and in the reduction of imines and aldehydes without having cyanide contamination issues.	Reductive amination	Color: Off-white Density: 0.705 g/mL Solvent Compatibility: 1 Prolonged Storage: 3 Shelf Life: 2 Years
SiliaBond DMAP PN: R75630B Loading: ≥ 0.53 mmol/g Endcapping: Yes		Used as a nucleophilic catalyst in a wide variety of reactions such as acylations and Baylis-Hillman reactions.	Acylations, esterification	Color: Light brown to brown Density: 0.674 g/mL Solvent Compatibility: 1 Prolonged Storage: 3 Shelf Life: 1 Year
SiliaCat DPP-Pd PN: RD-R390-100 Loading: 0.2 - 0.3 mmol/g (2.1 - 3.2 % Pd) Endcapping: Yes		Unique diphenylphosphine palladium (II) heterogeneous catalyst made from a leach-resistant organoceramic matrix used for coupling reactions.	Suzuki, Heck, Negishi, Borylation, Sonogashira, Kumada, Stille	Color: Orange Density: 0.300 - 0.400 g/mL Solvent Compatibility: 1 Prolonged Storage: 2 Shelf Life: 1 Year
SiliaBond Glycidoxy nec PN: R36030B Loading: ≥ 0.82 mmol/g Endcapping: No		Used as a linker for further modification of the surface and for the immobilization of molecules bearing amino, hydroxy, mercapto and thiocarboxylic acid groups.	Linker	Color: Off-white Density: 0.662 g/mL Solvent Compatibility: 1 Prolonged Storage: 2 Shelf Life: 2 Years
SiliaBond Guanidine PN: R68230B Loading: ≥ 0.80 mmol/g Endcapping: Yes		Used as a silica-bound guanidine moiety that is sufficiently basic to deprotonate moderately acidic hydrogens. It is most commonly used in Williamson ether synthesis.	Williamson ether synthesis, Strecker-type reactions, 1,4 addition reactions	Color: Light yellow Density: 0.732 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond KMnO₄ PN: R23030B Loading: 10 % w/w Endcapping: No		Strong oxidant that will oxidize methyl groups and alcohols to carboxylic acids. With Si-KMnO ₄ , the manganese salt by-products stay adsorbed onto the silica.	Oxidation of alcohols to acids	Color: Purple Density: 0.593 g/mL Solvent Compatibility: 5 Prolonged Storage: 1 Shelf Life: 2 Years

SiliaBond Reagents and Oxidants / SiliaCat Heterogeneous Catalysts Technical Information				
Products	Structure	Brief Description	Typical Reactions	Typical Characteristics ^{a, b}
SiliaBond Pyridinium Chlorochromate (PCC) PN: R24030B Loading: 20 % w/w Endcapping: No		Used for the oxidation of alcohols to carbonyl, selective oxidation of allylic and benzylic alcohols, organometallic oxidation, oxidative transpositions, oxidative cleavages, allylic and benzylic oxidation and oxidative cyclizations.	Oxidation of alcohols to aldehydes or ketones	Color: Orange Density: 0.693 g/mL Solvent Compatibility: 5 Prolonged Storage: 2 Shelf Life: 2 Years
SiliaBond Pyridinium Dichromate (PDC) PN: R24530B Loading: 20 % w/w Endcapping: No		Used for oxidizing allylic and benzylic alcohols, saturated with acid-sensitive groups, such as cyclopropane rings or ketal functions.		Color: Orange Density: 0.651 g/mL Solvent Compatibility: 5 Prolonged Storage: 2 Shelf Life: 2 Years
SiliaCat Pd⁰ PN: RD-R815-100 Loading: 0.2 - 0.3 mmol/g (2.1 - 3.2 % Pd) Endcapping: Yes		Patent-protected sol-gel-entrapped Pd nanocatalysts used for hydrogenation and coupling reactions.	Selective debenzoylation, selective hydrogenation, couplings (<i>Suzuki, Heck Sonogashira, Kumada, Stille</i>)	Color: Black Density: 0.300 - 0.400 g/mL Solvent Compatibility: 1 Prolonged Storage: 3 Shelf Life: 2 Years
SiliaBond Piperazine PN: R60030B Loading: ≥ 0.83 mmol/g Endcapping: Yes		Used deprotecting and scavenging agent for Fmoc and Bsmoc amino protecting groups and as a solid-phase Knoevenagel catalyst. SiliaBond Piperazine may also be used to scavenge electrophiles.	Knoevenagel synthesis, Fmoc and Bsoc deprotection, organic scavenger	Color: Off-white Density: 0.671 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond Piperidine PN: R71530B Loading: ≥ 1.03 mmol/g Endcapping: Yes		Used for the Knoevenagel condensation between carbonyl compounds and methylene malonic esters, to produce several important products, including nitriles used in anionic polymerization and unsaturated ester intermediates.	Knoevenagel condensation	Color: Off-white Density: 0.660 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond Propylsulfonic Acid (SCX-2) PN: R51230B Loading: ≥ 0.63 meq/g Endcapping: Yes		Supported sulfonic acid presenting a slightly more non-polar character than the SCX, thus reducing secondary interactions.	Acid catalysts, strong cation exchanger (SCX) for the amine "Catch and Release" purification	Color: Off-white Density: 0.728 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaCat Pt⁰ PN: RD-R820-100 Loading: 0.15 - 0.25 mmol/g (2.9 - 4.9 % Pt) Endcapping: Yes		Patent-protected sol-gel-entrapped Pt nanocatalysts used for selective reduction and hydrosilylations reactions.	Selective reduction of nitroarenes, hydrosilylation	Color: Black Density: 0.300 - 0.400 g/mL Solvent Compatibility: 1 Prolonged Storage: 3 Shelf Life: 2 Years
SiliaBond Tosic Acid (SCX) PN: R60530B Loading: ≥ 0.54 meq/g Endcapping: Yes		SiliaBond Tosic Acid is in a class of strong acids. The aromatic ring makes it slightly more acidic than other supported sulfonic acids Used as an acid catalyst for Fischer-Speier esterification provides excellent conversion.	Fisher-speier esterification, deprotection of aromatic ethers, fries rearrangement	Color: Off-white Density: 0.698 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years
SiliaBond Tosyl Chloride PN: R44030B Loading: ≥ 0.63 mmol/g Endcapping: Yes		SiliaBond Tosyl Chloride readily reacts with nucleophiles such as amines and alcohols. Reaction with alcohols yields the bound tosylate, which can then be used to synthesize amines and oxazolines.	Amine and oxazoline synthesis	Color: Off-white Density: 0.761 g/mL Solvent Compatibility: 4 Prolonged Storage: 3 Shelf Life: 6 months

^a **Solvent Compatibility:**
1- All solvents, aqueous and organic
2- All organic solvents
3- Anhydrous aprotic solvents
4- Anhydrous aprotic solvents, unstable in DMF
5- Anhydrous CH₂Cl₂

^b **Prolonged Storage:**
1- Keep dry
2- Keep cool (≤ 8°C) and dry
3- Keep cool (≤ 8°C), dry and under inert atmosphere



SiliaFlash and SiliaSphere PC – Bulk Silica Gels

SiliCycle is your partner of choice for your purification and chromatography needs! Recognized as one of the leaders with an excellent quality silica gel, SiliCycle offers a wide range of products available in two different shapes:

- SiliaFlash – Irregular Silica Gels
- SiliaSphere PC – Spherical Silica Gels

We offer one of the most reliable portfolios for flash and gravity grades for low to medium-high pressure. Our silica gels are ideal for preparative chromatography, from laboratory to pilot-plant processes and production scale. In addition to performance, SiliCycle's silica gels also ensure consistency, reliability and reproducibility.

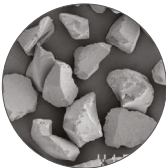
- **High purity silica with low level of fines**
No contamination, lower back-pressure and good separation
 - **Narrow particle and pore size distributions**
Optimal separation and resolution
 - **Batch-to-batch, year-to-year consistency**
Reliable chromatography
 - **Neutral pH**
Wide range of products can be purified, even acid sensitive ones
- **Low metal content and controlled water content**
Symmetrical peaks without tailing
 - **High mechanical stability**
Can be used under high pressures without surface abrasion
 - **High surface area and density**
Greater loading capacity, enabling more silica for the same volume. Solvent economy (*smaller dead volume*)
 - **Availability in bulk quantities**
Always in stock for fast delivery

Choosing Between SiliaFlash Irregular and SiliaSphere PC Spherical Gels

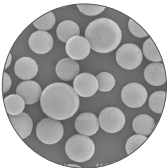
Irregular silica gels are traditional in flash or gravity chromatography and have always been a spontaneous choice for preparative chromatography. Nowadays, spherical particles are used increasingly. Cost is very important in preparative and process chromatography, and the use of monodisperse spherical particles with narrow particle size distribution is more expensive. It is possible in this case to use irregular silica but the separation may not provide the desired results. For these situations, SiliCycle has developed a more affordable class of spherical particles for preparative chromatography: SiliaSphere PC.

Advantages of SiliaSphere PC over standard irregular silica gels include the following:

- Increased efficiency of the eluent's flow characteristics
- Higher resolution
- Ease of packing / better packing reproducibility
- Higher mechanical stability



SiliaFlash® Irregular Silica



SiliaSphere™ PC Spherical Silica

SiliaFlash: Two Different Grades for Different Requirements

Over the years, SiliCycle has developed two different grades for the two most popular irregular gels used in the industry: 40 - 63 µm, 60 Å and 60 - 200 µm, 60 Å. Those two grades of each gel are available to address our customers' requirements, depending on their applications, areas of research, and budgets.

Two Different Grades of 40 - 63 µm, 60 Å Gel		
Grade	Superior Grade	Standard Grade
Name (PN)	F60 (R10030B)	P60 (R12030B)
Particularities	<ul style="list-style-type: none">• Extra step to reduce metal content to minimum level• Tighter particle size distribution• Fines have been removed	<ul style="list-style-type: none">• Fines have been removed• Lower price

Both compare favorably with the overall industry average of a 40 - 63 µm distribution, and each grade offers its own particle size distribution profile.

Two Different Grades of 60 - 200 µm, 60 Å Gel		
Grade	Superior Grade	Standard Grade
Name (PN)	G60 (R10040B)	GE60 (R10140B)
Particularities	<ul style="list-style-type: none">• Extra step to reduce metal content to minimum level• Tighter particle size distribution• Fines have been reduced to minimal level	<ul style="list-style-type: none">• Fines have been reduced to minimal level• Lower price

Each grade offers its own particle size distribution profile.

SiliaFlash & SiliaSphere PC Ordering Information

This is only an overview of gels we can provide. Please contact us if you are looking for a different product: support@silicycle.com. Available formats: from 1 kg to 25 kg, even up to multi-ton scale!

SiliaFlash Irregular Silica Gels Portfolio			
Product Number	Particle Size		Pore Diameter (Å)
	µm	mesh	
R10137L	75 - 150	100 - 200	30
R10130A	40 - 63	230 - 400	40
R10150A	60 - 120	325 - 625	
R10140A	60 - 200	70 - 230	
R10160A	120 - 200	70 - 125	
R10170A	200 - 500	35 - 70	
R10180A	500 - 1,000	18 - 35	
R10117B	15 - 40	*	60
R10023B	20 - 45	*	
R10030B (F60)	40 - 63	230 - 400	
R12030B (P60)			
R10530B (Acid-Washed)			
R10050B	60 - 120	325 - 625	
R10040B (G60)	60 - 200	70 - 230	
R10140B (GE60)			
R10137B	75 - 150	100 - 200	
R10160B	120 - 200	70 - 125	
R10165B	150 - 250	60 - 100	
R10170B	200 - 500	35 - 70	
R10180B	500 - 1,000	18 - 35	
R10130D	40 - 63	230 - 400	90
R10140D	60 - 200	70 - 230	
R10170D	200 - 500	35 - 70	
R10180D	500 - 1,000	18 - 35	
R10181D	800 - 1,200	16 - 22	
R10130H	40 - 63	230 - 400	150
R10150H	60 - 120	325 - 625	
R10140H	75 - 250	60 - 200	
R10160H	120 - 200	70 - 125	
R10170H	200 - 500	35 - 70	
R10180H	500 - 1,000	18 - 35	
R10181H	800 - 1,200	16 - 22	
R10130M	40 - 63	230 - 400	300
R10140M	60 - 200	70 - 230	
R10170M	200 - 500	35 - 70	

R10530B: Acid-washed SiliaFlash 40 - 63 µm, 60 Å irregular silica gel for extra purity

This product gel has been developed to ensure a pH-controlled media with even lower levels of trace metal contaminants and maximal purity.

SiliaSphere PC Spherical Silica Gels Portfolio			
Product Number	Particle Size		Pore Diameter (Å)
	µm	mesh	
S10095W-A	25	*	50
S10030B-A	50	300	60
S10040B-A	300	150	
S10020C	20 - 45	*	70
S10030C	40 - 75	200 - 400	
S10040C	75 - 200	70 - 200	
S10070C	200 - 500	35 - 70	
S10095D-A	25	*	90
S10020E	20 - 45	*	100
S10030E	40 - 75	200 - 400	
S10040E	75 - 200	70 - 200	
S10070E	200 - 500	35 - 70	
S10027G-A	50	300	120
S10020M	20 - 45	*	300
S10030M	40 - 75	200 - 400	
S10040M	75 - 200	70 - 200	
S10070M	200 - 500	35 - 70	
S10020P	20 - 45	*	500
S10030P	40 - 75	200 - 400	
S10040P	75 - 200	70 - 200	
S10070P	200 - 500	35 - 70	
S10020S	20 - 45	*	800
S10030S	40 - 75	200 - 400	
S10040S	75 - 200	70 - 200	
S10070S	200 - 500	35 - 70	
S10020T	20 - 45	*	1,000
S10030T	40 - 75	200 - 400	
S10040T	75 - 200	70 - 200	
S10070T	200 - 500	35 - 70	

* Mesh equivalent too small to exist as real screen size.



SiliaBond – Chromatographic Phases

Thanks to its high mechanical resistance, silica is the most widely used media in chromatography. With SiliaBond irregular silica gels, SiliCycle offers a large range of solutions for low pressure chromatography, to help cover many kinds of purification.

We guarantee quality and stability of our phases: no fines will appear when packing the media. Our gels will give you excellent performance and lifetime!

Solutions for Low Pressure Chromatography

For all our listed SiliaBond sorbents, particle size is 40 - 63 µm and pore diameter is 60 Å. Contact us if you need a different particle size or pore diameter: support@silicycle.com.

All functionalized SiliaBond sorbents are available in bulk but also pre-packed in SiliaPrep SPE cartridges and SiliaSep flash cartridges.

Reversed-Phases

In reversed-phase chromatography, the packing material is always hydrophobic (*non polar*) while the mobile phase is polar. The more hydrophobic the packing material, the more retention of non polar analytes.

Usual reversed-phases are standard alkyl chains grafted on silica (C18, C8, C4, C1) and cyclic or aromatic functions (Phenyl, Pentafluorophenyl).

Important parameters to keep in mind in reversed-phase chromatography:

- Carbon load** (% C) will give the relative hydrophobicity of the packing media. Most of the time, it varies between 5 % and 17 %.
- Endcapping**: when functionalizing silica, it is impossible to react with all available silanol groups (*free -OH groups on the silica surface*). But these free silanols are acidic and will react with basic compounds, so we endcap them with a capping agent to avoid non-specific bindings.

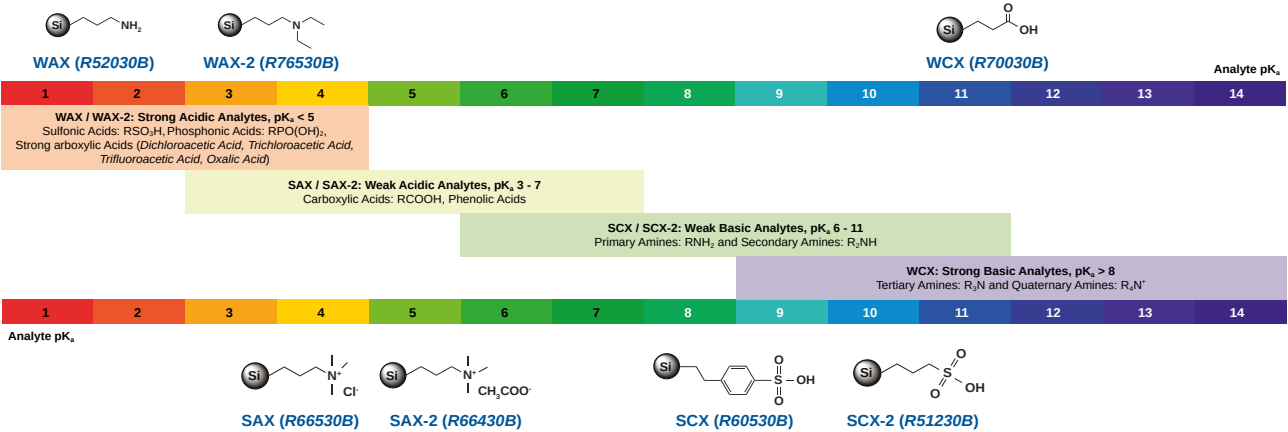
Normal Phases

In normal phase chromatography, the packing material is always polar while the mobile phase is non polar. The interactions between analytes and sorbent mainly take place on the highly polar silanols of the silica gel surface. Some hydrogen bonds can also happen on polar functionalized groups.

Usual normal phases are ungrafted silica, polar functions (*amine, cyano and diol*) or alternative adsorbents (*Alumina and Florisil* for example).

Ion Exchange Phases

In ion exchange chromatography, both silica support and analytes must be ionized. If the stationary phase (*packing material*) is positively charged, anionic analytes only will retain (*these phases are called WAX and SAX*). And in the contrary if the stationary phase is negatively charged, cationic analytes only will retain (*these phases are called WCX and SCX*). Hence, pH of the mobile phase is of crucial importance and needs to be chosen carefully, so that both functions are charged:

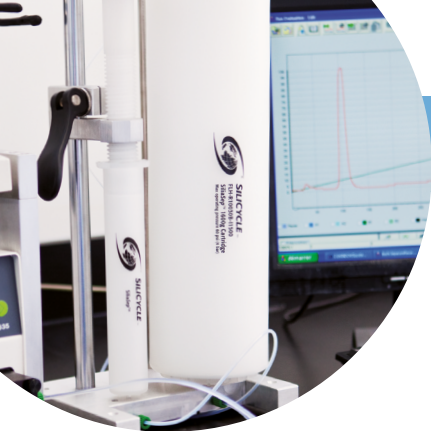


Portfolio

Available formats: from 5 g to 25 kg.

Low Pressure Chromatography Phases Portfolio		
Sorbent	Characteristics	Typical Applications
C18 PN: R33230B	% C: ≥ 17 % Density: 0.639 g/mL	<ul style="list-style-type: none">Purification of low to high polarity compoundsReproducible purification without complexity and cost of preparative HPLC
C8 PN: R30830B	% C: ≥ 11.0 % Density: 0.586 g/mL	<ul style="list-style-type: none">Less retention compared to C18For highly hydrophobic pesticides, small peptides and large molecule drugs
Pentafluorophenyl (PFP) PN: R67530B	% C: ≥ 9.0 % Density: 0.761 g/mL	<ul style="list-style-type: none">For alternative selectivity, with aromatic ring interactionsFor purification of conjugated compounds (<i>isomers</i>)
Phenyl (PHE) PN: R34030B	% C: ≥ 8.0 % Density: 0.637 g/mL	<ul style="list-style-type: none">Moderately non-polar sorbentAlternative selectivity for aromatic compounds, compared to other reversed-phases
C4 PN: R32030B	% C: ≥ 8.0 % Density: 0.656 g/mL	<ul style="list-style-type: none">Less retention compared to C18 and C8For molecules with large hydrophobic regions
C1 PN: R33030B	% C: ≥ 5.0 % Density: 0.559 g/mL	<ul style="list-style-type: none">Lower retention compared to other reversed-phasesFor purification of polar and non-polar highly hydrophobic pharmaceutical products
Cyano (CN) PN: R38030B	% C: ≥ 7.0 % % N: ≥ 1.93 % Loading: ≥ 1.38 mmol/g Density: 0.703 g/mL	<ul style="list-style-type: none">Versatile sorbent that can be used either as normal or reversed-phaseLess polar than silicaFor organic compounds with intermediate to extreme polarity
Silica (Si) PN: R10030B	Density: 0.550 g/mL	<ul style="list-style-type: none">Most popular sorbent for day-to-day useFor purification of non-ionic polar organic compounds
Silica Premium PN: S10095D-A	Particle size: 25 µm Pore size: 90 Å Density: 0.450 g/mL	<ul style="list-style-type: none">High performance sorbent for difficult separations (<i>isomers</i>)Higher loading capacity, faster flow rate, less solvent used
Diol nec PN: R35030B	Loading: ≥ 0.97 mmol/g Density: 0.687 g/mL	<ul style="list-style-type: none">For difficult separation of low to medium polarity samplesCan be used in HILIC modeFor mono and polysaccharides separation
Acidic, Neutral and Basic Alumina PN: AUT-0053 AUT-0054 AUT-0055	Particle size: 75 - 150 µm Pore size: 70 Å	<ul style="list-style-type: none">For aromatic compounds, aliphatic amines & compounds containing electronegative functions
Florisil PN: AUT-0014	Particle size: ≤ 75 µm Pore size: 80 Å	<ul style="list-style-type: none">For separation of chlorinated pesticides, polychlorinated biphenyls (PCBs) & polysaccharides
Silver Nitrate (AgNO₃) PN: R23530B	Loading: 10 % w/w Density: 0.604 g/mL	<ul style="list-style-type: none">For separation of cis / trans isomers of unsaturated compounds (<i>alkenes, lipids, steroids and terpenes</i>)
Amine (NH₂, WAX) PN: R52030B	Loading: ≥ 1.2 mmol/g Density: 0.700 g/mL	In normal phase: for purification of compounds with basic properties, or for monosaccharides separation In ion exchange: <ul style="list-style-type: none">Weak anion exchanger (pK_a of 9.8), positively charged at pH below 7.8For very strong anions (<i>such as sulfonic acids</i>), that may be too strongly retained on SAX phases
WAX-2 (Triethylamine) PN: R76530B	Loading: ≥ 1.04 mmol/g Density: 0.761 g/mL	<ul style="list-style-type: none">Weak anion exchanger (pK_a of 10.5), positively charged at pH below 8.5For catch & release of compounds bearing a permanent negative charge (<i>ie salts of sulfonic acids</i>)
SAX (TMA Chloride) PN: R66530B	Loading: ≥ 0.90 meq/g Density: 0.700 g/mL	<ul style="list-style-type: none">Strong anion exchanger, permanently positively charged (<i>pH independant</i>)For weak anions (<i>such as carboxylic acids</i>) that may not bind strongly enough on WAX phasesFor analysis of acidic drugs / analgesics, biomolecules & water-soluble vitamins
SAX-2 nec (TMA Acetate) PN: R66430B	Loading: ≥ 0.71 mmol/g Density: 0.665 g/mL	<ul style="list-style-type: none">Strong anion exchanger with easily exchangeable acetate counter-ion (<i>more than chloride ion</i>)For compounds with $pK_a < 5$ (<i>such as carboxylic acids</i>)
SCX (Tosic Acid) PN: R60530B	Loading: ≥ 0.54 meq/g Density: 0.698 g/mL	<ul style="list-style-type: none">Strong cation exchangers ($pK_a < 1$), permanently negatively charged (<i>pH independant</i>)For catch and release purification of weak cations (<i>basic drugs / analgesics, biomolecules and water-soluble vitamins</i>)
SCX-2 (Propylsulfonic Acid) PN: R51230B	Loading: ≥ 0.63 meq/g Density: 0.728 g/mL	
WCX (Carboxylic Acid) PN: R70030B	Loading: ≥ 0.92 mmol/g Density: 0.687 g/mL	<ul style="list-style-type: none">Weak cation exchanger (pK_a of 4.8), neutralized at pH below 2.8For strong cationic species, that may bind too strongly on SCX phases

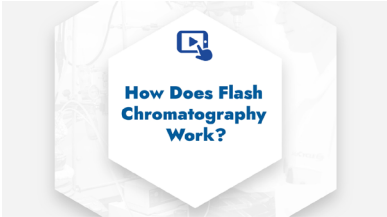
For all sorbents, particle size is 40 - 63 µm and pore diameter is 60 Å.
All bonded phases are available endcapped and non-endcapped.
Other phases could be offered on a custom basis, contact us for more information: info@silicycle.com.



SiliaSep – Flash Cartridges

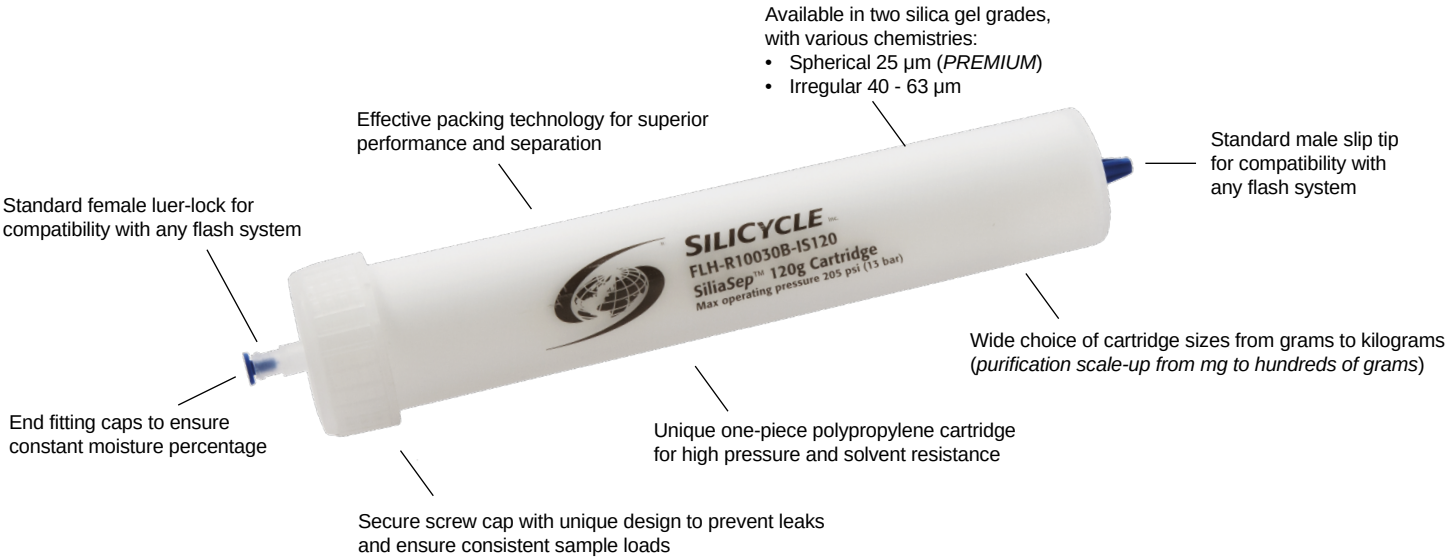
Flash chromatography is one of the most used methods for compounds purification. Several types of flash chromatography are available, and it has been showed that the use of pre-packed flash cartridges improves purification efficiency compared to conventional flash, by offering superior reproducibility and productivity due to its tightly and homogeneously packed silica bed.

With SiliaSep, benefit from SiliCycle's renown quality: selectivity, speed, and reliability.



Video: How flash chromatography works

Cartridge Design



Features and Benefits

- High silica gel quality, with low level of fines**
- No product contamination
 - Homogeneous packing, no channelling (*no peak tailing*)
 - High loading capacity (*high surface area*)
 - Direct transfer from TLC to flash chromatography
- Reproducibility, reliability and safety**
- Leak-free guaranteed by unique one-piece cartridge design
 - Batch-to-batch reproducibility (*stringent quality control*)
 - Excellent durability to withstand high pressures
 - Universal luer fittings for compatibility with any flash system

- Versatility**
- Wide choice of cartridge sizes from 4 g to 3 Kg
 - Purification scale-up from milligrams to kilograms
 - Variety of sorbents to meet any separation needs

- Effective packing technology**
- Consistent packing for reproducible high plate count (*N*)
 - Excellent performance and separation
 - High resolution with tight band definition (*no tailing*)
 - Great compound purity and recovery

- Cost effectiveness**
- Excellent performance / price ratio
 - Readily available, even for large volumes

Portfolio

All our bare and bonded silica gels are available to be packed in SiliaSep flash cartridges to accomodate your chemistry.

SiliaSep Flash Cartridges Adsorbents	
Adsorbent Type	Adsorbent
Backbone	• Standard SiliaFlash Irregular Silica, 40 - 63 µm, 60 Å
	• PREMIUM Spherical Silica, 25 µm, 90 Å
	• Acidic, Neutral and Basic Alumina, 50 - 75 µm, 55 Å
Bonded phases	• SiliaBond Chromatographic Phases (<i>reversed, normal and ion exchange phases</i>)
	• SiliaMetS Metal Scavengers (<i>Thiol, DMT, etc.</i>)
	• SiliaBond Organic Scavengers (<i>Amine, Tosic Acid, etc.</i>)



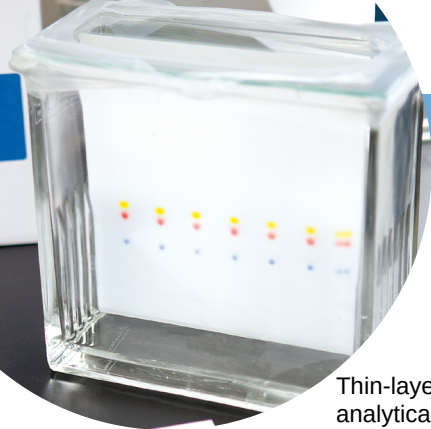
Formats

SiliaSep Flash Cartridges Portfolio							
Cartridge Format [Code]	Silica Weight (g)	Qty / Box	Dimensions (Diam. x Length*) (mm)	Column Volume (mL)	Recommended Flow Rate (mL)	Loading Capacity (g)	Max Operating Pressure (psi / bar)
Discovery & R&D	SiliaSep 4 g [ISO04]	Bare: 4 Bonded: ≥ 5	20 2	12 x 98	4.9	15 - 25	Bare: 0.04 - 0.4 Bonded: 0.02 - 0.2
	SiliaSep 12 g [ISO12]	Bare: 12 Bonded: ≥ 15	20 1	21 x 117	17	20 - 40	Bare: 0.12 - 1.2 Bonded: 0.06 - 0.6
	SiliaSep 25 g [ISO25]	Bare: 25 Bonded: ≥ 30	15 1	21 x 165	31	20 - 45	Bare: 0.25 - 2.5 Bonded: 0.125 - 1.25
	SiliaSep 40 g [ISO40]	Bare: 40 Bonded: ≥ 45	15 1	27 x 169	47	25 - 50	Bare: 0.4 - 4 Bonded: 0.2 - 2
	SiliaSep 80 g [ISO80]	Bare: 80 Bonded: ≥ 90	12 1	31 x 237	123	40 - 80	Bare: 0.8 - 8 Bonded: 0.4 - 4
	SiliaSep 120 g [IS120]	Bare: 120 Bonded: ≥ 130	10 1	36 x 256	190	60 - 120	Bare: 1.2 - 12 Bonded: 0.6 - 6
Development & Process	SiliaSep 220 g [IS220]	Bare: 220 Bonded: ≥ 230	4 1	60 x 195	306	60 - 190	Bare: 2.2 - 22 Bonded: 1.1 - 11
	SiliaSep 330 g [IS330]	Bare: 330 Bonded: ≥ 360	4 1	60 x 268	441	80 - 190	Bare: 3.3 - 33 Bonded: 1.65 - 16.5
	SiliaSep XL 800 g** [IS750]	Bare: 800 Bonded: ≥ 870	2 1	78 x 382	1,500	200 - 300	Bare: 8 - 80 Bonded: 4 - 40
	SiliaSep XL 1,600 g** [I1500]	Bare: 1,600 Bonded: ≥ 1,700	2 1	104 x 429	2,900	300 - 450	Bare: 16 - 160 Bonded: 8 - 80
	SiliaSep XL 3 Kg** [ISO3KG]	Bare: 3,000	1	128 x 510		200 - 500	Bare: 30 - 300

* Cartridge length includes luer-lock and connection tip.
** For SiliaSep XL formats, you may need to use an XL Adapter to connect the cartridge onto your system. Part number AUT-0127-2.



Solid-load cartridges & plungers also available!
Contact us: info@silicycle.com



SiliaPlate – TLC Plates

- Wide choice of sizes, sorbents, and thicknesses available
- Excellent reproducibility between SiliaPlate TLC plates and bulk silicas or flash cartridges

Thin-layer chromatography (TLC) is a quick, simple, inexpensive, and extremely versatile technique for both analytical and preparative analysis. Widely used in numerous scientific fields, it is particularly popular for reaction monitoring and screening, compound contamination assessment, and sample purification.

Why choose SiliaPlate?

SiliaPlate represents an efficient and economical alternative to other TLC plate manufacturers while demonstrating high separation power, thanks to our narrow particle size distribution silica gel.

The hardness of our silica layer, combined to a homogeneous coating and layer thickness, allows excellent separations. Each TLC batch is chemically and physically controlled by our Quality Control department to ensure lot-to-lot and layer-to-layer reproducibility.

Sorbents

Available Sorbents		
Non-functionalized Silica Gel	Reversed-Phases	Normal Phases
<p>A universal matrix for daily, fast, reliable analysis of the largest spectra of molecules</p> <p>The particle size distribution used for the silica is related to the nature of the plate.</p> <p>For standard TLC, silica gel with a mean particle size of 10 - 14 µm is used compared to HPTLC, where a smaller particle size is required.</p> <p>In both cases, pore diameter is always 60 Å.</p>	<p>The two most popular modes of separation employed in TLC are normal and reversed-phases.</p> <p>In normal phase separation, the mobile phase is less polar than the stationary phase. Inversely, in reversed mode, the mobile phase (<i>usually a mixture of water and organic solvent</i>) is more polar than the stationary phase.</p> <p>When satisfactory separations cannot be achieved by unmodified silica, other functionalized matrices have been designed for specific applications:</p>	<p>C2, C8 and C18 phases are functionalizations of silica performed using organosilanes of various chain lengths. Retention of molecules & ability to tolerate water in the moving phase are directly dependent on the chains length.</p> <p>Diol and Cyano (CN) are moderately polar. They can thus be suitable for both normal and reversed-phase chromatography, depending on your application.</p> <p>Amino phases (NH₂) show weak anion exchange characteristics, great for charged compounds.</p> <p>AgNO₃ (<i>Silver Nitrate 10 - 15 or 20 % impregnated</i>) are used particularly for C=C double-bonded compounds</p>

TLC Backings

TLC plates are available with different backings: rigid (*glass-backed*) and flexible (*aluminum and plastic-backed*).

TLC Backings Comparison			
Properties	Glass	Aluminum	Plastic
Advantages	<ul style="list-style-type: none">• Rigid• High chemical resistance• High heating stability and charring resistance• Transparent	<ul style="list-style-type: none">• Thin and low fragility• Low weight & consequent shipping costs• High heating stability• Possible to cut with scissors• Can be stored in notebook	<ul style="list-style-type: none">• Thin• Low fragility• Possible to cut with scissors• High chemical resistance• Can be stored in notebook
Disadvantages	<ul style="list-style-type: none">• Thick and high fragility• Impossible to cut with scissors• Cannot be stored in lab notebook• High weight & consequent shipping costs• Large shelf space	<ul style="list-style-type: none">• Low chemical resistance• Opaque	<ul style="list-style-type: none">• Medium weight• Opaque• Heating stability up tp 175°C• Possible cracking of matrix due to high flexibility
Thickness (<i>approx.</i>)	2.0 - 2.5 mm	1.5 - 2.0 mm	1.5 - 2.0 mm
Heating Stability	High	High	Below 175°C
Fragility	High	Low	Low
Cutting with Scissors	Impossible	Easily	Possible
Chemical Resistance	High	Low	High

Plate Types

SiliCycle offers different types of plates for thin-layer chromatography applications: classical TLC, high performance TLC (*also called HPTLC*) and preparative TLC (*PLC*). The plate types are selected based on the type of analysis required and the available budget.

Differences Between Classical TLC, HPTLC, and PLC			
Properties	Classical TLC	HPTLC	Preparative TLC (PLC)
Applications	Quick, inexpensive, flexible and classical separations	Highly sophisticated separations, complex samples	Purification on a TLC plate
Analysis	Qualitative	Qualitative and quantitative	Quantitative
Detection	UV - Stains	Instrumented analysis (<i>use of scanners for detection</i>)	UV
Distribution [<i>Mean Particle Size</i>]	5 - 20 µm [<i>10 - 14 µm</i>]	4 - 8 µm [<i>5 - 6 µm</i>]	5 - 40 µm [<i>22 - 25 µm</i>]
Layer Thickness	200 - 250 µm	150 - 200 µm	500 - 2,000 µm
Typical Sample Volume	1 - 5 µL	0.1 - 0.5 µL	5 - 20 µL

CLASSICAL TLC Plates

Glass

- Analytical SiliaPlate TLG-R10014B-323 BEST SELLER
- Scored Analytical SiliaPlate
- Channeled Analytical SiliaPlate (*with or without Preadsorbent Zone*)
- Specialty Sorbents SiliaPlate
 - SiliaPlate AgNO₃ TLC (*Silver Nitrate 10 - 15 or 20 % impregnated*): particularly for C=C double-bonded compounds
 - SiliaPlate Aluminum Oxide TLC: great for alkaloids, aliphatic compounds, aromatics, steroids

Aluminum

- SiliaPlate Al TLA-R10011B-323 BEST SELLER
- SiliaPlate Al C18

Plastic

- SiliaPlate PI

High Performance TLC (HPTLC) Plates

SiliaPlate Bare HPTLC

SiliaPlate Reversed-Phase Modified HPTLC

- SiliaPlate C18 HPTLC
- SiliaPlate C8 HPTLC
- SiliaPlate C2 HPTLC

SiliaPlate Normal Phase Modified HPTLC

- SiliaPlate NH₂ (*Amine*) HPTLC: a weak anion exchanger, ideal when dealing with charged compounds
- SiliaPlate CN (*Cyano*) HPTLC: moderately polar, hence suitable for both normal & reversed chromatography depending on your needs
- SiliaPlate Diol HPTLC

PREPARATIVE TLC Plates

- SiliaPlate Prep TLG-R10011B-341 BEST SELLER
- Scored SiliaPlate Prep
- SiliaPlate C18 Prep ; AgNO₃ Prep ; Alumina Prep

TRIAL PACKAGE

Trial Package of Functionalized SiliaPlate TLC Plates with Glass Backing (*5 plates of each, scored to 2.5 x 10 cm, 25 / box*)

Composition: C18, C8, C2, NH₂, and CN

ACCESSORIES

- SiliaPlate Rectangular TLC Developing Chamber
- Cutting tool for glass-baked TLC plates
- Pencil Glass Cutter for SiliaPlate
- Scrapper for TLC Plates



SiliaPrep – SPE Cartridges and Well Plates

SiliCycle, the right choice for:

- Wide variety of sorbents
- Tight particle size distribution
- Very good packing (*no fines*)
- High recovery and yield

Silica-based SiliaPrep and Polymeric SiliaPrepX

Solid-phase extraction (SPE) is designed for rapid sample preparation and purification prior to chromatographic analysis.








Our SiliaPrep (*silica-based*) and SiliaPrepX (*polymeric*) families of SPE cartridges and well plates have been created to cover the entire spectrum of solid-phase extraction. This complete range of sorbents allows treatment of most common matrices:

- human and animal biological fluids
 - waste waters
- petrochemical residues
 - toxicological residues
- food and beverage

SiliaPrep and SiliaPrepX products are made using state-of-the-art technology, giving you the highest quality and the best lot-to-lot reproducibility. These advanced sorbents are providing you a clean extract, reducing ion suppression and increasing selectivity for LC/MS/MS applications.

Cartridge sizes

We can provide a complete range of SPE cartridge lengths and diameters.

SiliaPrep Cartridge Sizes							
	1 mL	3 mL	6 mL	12 mL	25 mL	70 mL *	150 mL *
Dimensions (Diam. x Length)	5.7 x 65.7 mm	8.9 x 74.7 mm	12.7 x 77.8 mm	15.8 x 90 mm	20.5 x 100 mm	26.8 x 154 mm	38.2 x 170 mm
Bed Weights Available	30 - 100 mg	30 - 500 mg	100 mg - 2 g	500 mg - 2 g	1 - 5 g	5 - 20 g	25 - 70 g
							

* Commercialized under SiliaSep OT branding. Please see product page [here](#).

Tips for your method development

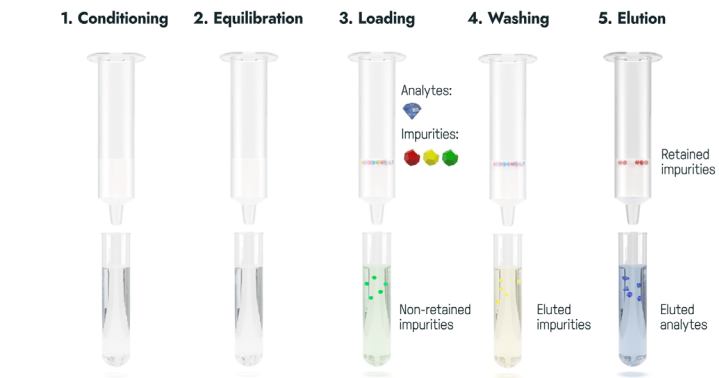
Tips for Your Method Development		
Sorbent Type	Silica-Based (SiliaPrep)	Polymeric (SiliaPrepX)
Sorbent Capacity	Load up to 5 % of bed weight: 100 mg of silica-based sorbent will retain up to 5 mg of sample	Load up to 10 % of bed weight: 100 mg of polymeric sorbent will retain up to 10 mg of sample

Not enough sorbent: ANALYTE LOSS ► low recovery and reproducibility
Too much sorbent: MORE EXPENSIVE ► more solvent used, taller SPE cartridges
Concentrated samples: double the bed weight to avoid analyte loss

Portfolio

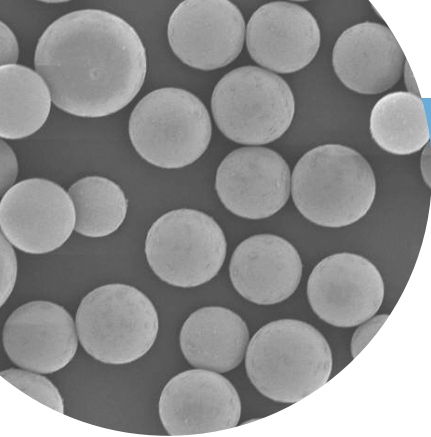
Available Phases

SPE Cartridges and Well Plates Portfolio		
Mode	SiliaPrep Phase	Application
Reversed-Phases: non-polar sorbents	SiliaPrep C18 (<i>endcapped, WPD Widepore, nec</i>)	For organic compounds from water, drugs and metabolites from fluids
	SiliaPrep C8 (<i>endcapped, nec</i>)	For extremely non-polar and large compounds (<i>PAH, vitamin D, oils</i>)
	SiliaPrep Phenyl (<i>PH</i>) and Pentafluorophenyl (<i>PF</i>)	For aromatic compounds, complex natural products
Normal Phases: polar sorbents	SiliaPrep Cyano (<i>CN</i>)	For acidic, basic and neutral compounds from aqueous solutions
	SiliaPrep Diol <i>nec</i>	For polar compounds from non-polar solvents, structural isomers
	SiliaPrep Silica and Silica WPD (<i>Widepore</i>)	For various compounds from non-polar solvents, structural isomers
	SiliaPrep Florisil and Florisil PR (<i>Pesticide Residues</i>)	For chlorinated pesticides, PCB's and polysaccharides
	SiliaPrep Alumina (<i>Acidic, Neutral and Basic</i>)	For aromatic compounds and aliphatic amines
Ion Exchange Phases: ionic sorbents	SiliaPrep SAX and SAX-2 (<i>TMA Chloride and Acetate</i>) <i>nec</i>	For weakly acidic molecules (pK_a 3 - 5)
	SiliaPrep Carbonate	For scavenging of TFA, extraction of acids (<i>boronic acids and acidic phe-nols</i>)
	SiliaPrep Amine (<i>WAX</i>)	For strongly acidic molecules (pK_a < 3), structural isomers, saccharides
	SiliaPrep SCX and SCX-2 (<i>Tosic and Propylsulfonic Acids</i>)	For weakly basic molecules (pK_a 7 - 9), catch and release of amines
	SiliaPrep WCX (<i>Carboxylic Acid</i>)	For strongly basic compounds (pK_a > 9)
Specialty Phases	SiliaPrep PCB	For extraction of PCB's from waste oil (<i>hexane extract</i>)
	SiliaPrep CleanDRUG	For drugs of abuse applications
	SiliaPrep CleanENVI	For PAH's, PCB's, herbicides and pesticides from waste waters
	SiliaPrep PAH	For PAH's from waste waters
Polymeric Phases	SiliaPrepX HLB and DVB	For drugs and metabolites from biological fluids, API from tablets and cream
	SiliaPrepX SAX and WAX	For acidic compounds and metabolites, highly stable in organic solvents
	SiliaPrepX SCX and WCX	For basic compounds, highly stable in organic solvents
Metal Scavengers	SiliaPrep Cysteine, Diamine, DMT, DOTA, Imidazole, TAAcOH, TAAcONa, Thiol, Thiourea, Triamine	For lowering the residual metal concentration of various metal complexes (<i>Pd, Pt, Rh, Ru, Ni, Sn, etc</i>) to single digit ppm



Video: The 5 steps of SPE

Vacuum manifolds 12 and 24 positions also available!
Contact us: info@silicycle.com



SiliaSphere – Spherical Silica Gels

- The right choice for...
- Chromatographic performance
 - Loading capacity
 - Reproducibility
 - Chemical and physical stability

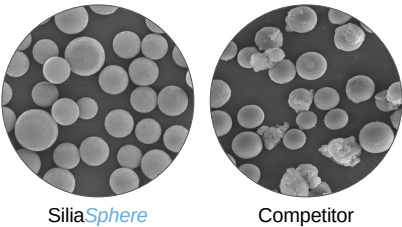
SiliaSphere as a Silica Matrix

SiliCycle has a strong know-how and expertise in silica gel manufacturing. To support the increasing demand on our spherical silicas, we have developed an optimized and highly controlled large-scale production process for all of our SiliaSphere products without decreasing the quality of the silica.

Particle shape, pore and particle size distributions, silica gel purity and surface properties, all have their influence on chromatographic performance. Therefore, in order to develop the most efficient process, all these parameters need to be evaluated and optimized to ensure batch-to-batch reproducibility.

SiliaSphere is manufactured from an organic form of silicon (alkoxydes). This ensures very low metal content as the starting material is purified by distillation. Deionized water is used to hydrolyze the silicon alkoxydes. Careful monitoring and control of the parameters that induce precipitation provide spherical silica gels with the desired characteristics. SiliaSphere products are characterized by a very low metal content and exceptional stability. Furthermore, our manufacturing process ensures quality and reproducibility in pore size, surface area, particle size, and morphology for all SiliaSphere products.

Perfectly Spherical Particle Shape




The perfectly spherical shape of SiliaSphere silicas, combined to their smooth surfaces free of any cracks, cavities and fines make them the packing of choice for chromatography.

SiliaSphere sphericity compares favorably to well-known brands in spherical silica gel, as demonstrated by the scanning electron microscope (SEM) left picture.

Features and Benefits of SiliaSphere Spherical Silica Gels

- **High purity silica gels**
Consistency, reliability and reproducibility
 - **Perfect spherical shape, free of any cavities or cracks**
Ease of column packing and high resolution
 - **Exceptional narrow particle size distribution**
Optimal separation and resolution
- **Strong mechanical stability**
Low back-pressure without surface abrasion
 - **Same well controlled processes for all SiliaSphere**
Easy scalability
 - **Availability in bulk quantities at affordable price**
On-time delivery

Characteristics

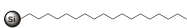



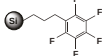

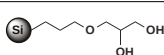


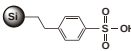

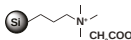
 SiliaSphere Monodispersed Typical Characteristics				
Pore Diameter	60 Å	100 Å	300 Å	1,000 Å
Specific Surface Area (m²/g)	≥ 450	≥ 400	≥ 80	≥ 20
Pore Volume (mL/g)	0.85 - 1.15		0.75 - 1.05	
pH (5 % w/w)	1.5 - 7			
Available Particle Sizes (µm)	3, 5, 10	3, 5, 10	3, 5, 10	10

Functionalized Spherical Silicas

Silica surface possesses active silanols (Si-OH, free OH groups of the silica), which permits the modification of the surface chemistry by grafting silane moieties. This property allows control of the surface polarity, useful in separation techniques. Various types of silanes can be grafted on the surface to afford monomeric or polymeric bonded phases.

In liquid chromatography, there are various modes of operation possible, based on the interaction mechanism of the solute with the stationary phase (sorbernt). Most known separation modes are summarized in the table below.

Most Popular Bonded Phases			
Mode	Normal Phase (NP)	Reversed-Phase (RP)	Ion Exchange Phase (IEX)
Mode Mechanism	Polar or hydrophilic	Non-polar or lipophilic / hydrophobic	Ionic
Typical Stationary Phase	Bare silica or polar functionalized silica (Amine, Cyano or Diol)	Functionalized silica (mostly C18, C8, C4, Cyano, Phenyl and PFP)	Ionic functionalized silica (SAX, SCX, WAX, WCX)
Stationary Phase Polarity	Polar	Non-polar	Anionic or cationic exchanger
Typical Mobile Phase	Non-polar organic solvents such as hexane, EtOAc, dichloromethane, THF	Mixtures of water or aqueous buffers and organic solvents (mostly ACN, MeOH, THF), ion pairing agents can also be added	Water, buffers, acid, base
Mobile Phase Polarity	Non-polar	Polar	Buffer or ionic

Typical Applications of Most Common Bonded Phases					
Sorbent Phase	Functional Group	Mode			Typical Applications
		NP	RP	IEX	
C18			✓		Great start for method development. Presents the maximum retention of non-polar compounds. Typically used for peptides, pesticides, PCBs, PAHs, drugs, etc.
C8			✓		Presents less retention compared to C18. Mainly used for highly hydrophobic pesticides, small peptides and heavy drugs.
C4			✓		Presents less retention compared to C18 and C8. Widely used for molecules with large hydrophobic regions such as peptides, proteins and zwitterions (<i>in 300 Å</i>).
Phenyl (<i>PHE</i>)			✓		Moderate non-polar sorbent with different selectivity for aromatic compounds compared to other non-polar sorbents.
Pentafluorophenyl (<i>PFP</i>)			✓		For a new selectivity approach or the purification of conjugated compounds (<i>isomers</i>).
Cyano (<i>CN</i>)		✓	✓		In reversed-phase: moderate non-polar sorbent with less hydrophobicity than C18 or C8. Purification of cyclosporine and carbohydrates. In normal phase: less polar sorbent compared to silica, used for the purification of polar organic compounds.
Diol		✓			Moderate polar sorbent with a neutral character. Used to extract polar compounds. Alternative to silica when acidic character is problematic.
Silica		✓			Most polar sorbent with a slight acidic character. Used for purification of polar and non-ionic compounds.
Amine (NH_2 , <i>WAX</i>)		✓		✓	In normal phase: polar sorbent with a basic character, with less retention and a different selectivity for acidic / basic compounds compared to silica. In ion exchange mode: a weak anion exchanger with pK_a of 9.8. At pH 7.8 or below, the functional groups are positively charged. It facilitates the rapid release of very strong anions (<i>such as sulfonic acids</i>) that may be retained irreversibly on SAX.
Tosic Acid (<i>SCX</i>)				✓	Due to the very low pK_a (< 1), this silica is a strong cation exchanger. The most common use is likely for catch and release purification of weak cations.
TMA Chloride (<i>SAX</i>)				✓	The quaternary amine is permanently positively charged, and commonly used for the extraction of weak anions that may not bind strongly enough to weaker anion exchangers (<i>WAX</i>).
TMA Acetate (<i>SAX-2</i>)				✓	The acetate counter ion is easier to exchange compared to the chloride ion. It is used for compounds with $pK_a < 5$, such as carboxylic acids, or to selectively purify acidic compounds or remove acidic impurities from reaction mixtures.



SiliaChrom – HPLC Columns

- Excellent efficiency and column-to-column reproducibility
- Long lifetime
- Broad pH range from 1.5 to 9
- Compatibility with 100 % aqueous and organic mobile phases
- High surface coverage presenting no bleeding for LC/MS applications

SiliCycle offers a wide range of chromatographic selectivities: reversed-phase, normal phase and ion exchange phase columns for analysis of acidic, neutral and basic compounds. We also have solutions for biochromatography of large molecules and analysis by SFC (*Supercritical Fluid Chromatography*).

Our R&D group works to continually enhance our portfolio to suit customer's requirements. Whether you need stability with 100 % aqueous or organic mobile phases, or low bleed material for LC/MS applications: we have the solution for you.

All our columns are available in 3, 5 and 10 µm, with internal diameters from 4.6 to 50 mm.

Both our raw materials and finished HPLC columns are QC-validated in our ISO 9001:2015 registered manufacturing facilities.

Manufacturing is done following strict SOPs to guarantee:

- **Extremely pure silica**
- **Complete endcapping (*meaning reduced silanol activity*)**
- **Controlled surface coverage**
- **High surface area and loading capacity**
- **Exceptional chemical and mechanical stability**
- **Uniform column bed**
- **Enhanced chromatographic resolution**
- **Very good peak symmetry**
- **Robust columns with extended lifetime**
- **Lot-to-lot and column-to-column reproducibility**



Portfolio

HPLC Columns Portfolio	
SiliaChrom Plus	SiliaChrom dt
For your everyday separations	100 % aqueous compatible
<ul style="list-style-type: none">• C18 & C18-300 (<i>USP L1</i>)• C8 & C8-300 (<i>USP L7</i>)• PFP (<i>USP L43</i>)• Phenyl (<i>USP L11</i>)	<ul style="list-style-type: none">• C18 (<i>USP L1</i>)
Main Characteristics	
<ul style="list-style-type: none">• Wide range of selectivities• Ultra pure metal-free silica (99.999 % <i>purity</i>)• High column performance and resolution• Enhanced batch-to-batch reproducibility• Extended column lifetime• Reduced silanol activity, better peak symmetry• Extremely low bleeding for LC/MS applications• Easy scale-up to preparative formats	<ul style="list-style-type: none">• Ultra pure metal-free silica (99.999 % <i>purity</i>)• High sensitivity for LC/MS• Stable from 100 % aqueous to 100 % organic mobile phase• Universal: acidic, neutral, and basic analysis• Enhanced retention of hydrophilic molecules• Inertness for acidic and basic analytes

SiliaChrom Plus and dt Sorbent Characteristics								
SiliaChrom Phase	Description	% C*	Endcapping	Pore Size (Å)	Surface Area (m²/g)	pH Range	Temp. Limit (°C)	Pressure Limit (psi)
Reversed-Phases								
SiliaChrom Plus C18	2 levels of hydrophobicity for almost all your everyday analytes.	17	Yes	100	370 - 430	2.0 - 8.0	60	5,500
SiliaChrom Plus C8		10	Yes	100	370 - 430	2.0 - 8.0	60	
SiliaChrom Plus C18-300	2 levels of hydrophobicity to separate your larger analytes.	8	Yes	300	80 - 120	2.0 - 8.0	60	4,000
SiliaChrom Plus C8-300		5	Yes	300	80 - 120	2.0 - 8.0	60	
SiliaChrom Plus PFP	Highly retentive phase for aromatic and polar compounds.	11	Yes	120	320 - 360	2.0 - 8.0	60	5,500
SiliaChrom Plus Phenyl	Highly retentive phase for aromatic and unsaturated compounds.	9	Yes	100	370 - 430	2.0 - 8.0	60	5,500
Normal Phases								
SiliaChrom Plus Silica	Designed for normal phase conditions, to analyse small polar compounds.	-	-	100	370 - 430	2.0 - 8.0	60	5,500
SiliaChrom Plus Silica-300	Designed for normal phase conditions, to analyse larger polar compounds.	-	-	300	80 - 120	2.0 - 8.0	60	4,000
SiliaChrom Plus Cyano	For small polar analytes, works in normal and reversed-phase conditions.	7	Yes	100	370 - 430	2.0 - 8.0	60	5,500
SiliaChrom Plus Amine	Recommended for normal phase analysis, especially for sugar analysis.	8	Yes	100	370 - 430	2.0 - 8.0	60	5,500
dt Phase								
SiliaChrom dt C18	Separation of hydrophobic molecules in aqueous or organic conditions. Compatible with 100 % aqueous and 100 % organic mobile phases.	18	Yes	100	410 - 440	1.5 - 9.0	60	5,000



Guard cartridges also available!
Contact us: info@silicycle.com



SiliCycle R&D Services

- We listen. We understand. We work with you.
- We are flexible, committed, reliable, and innovative.
- Our objective: reinvesting our experts' talent in your very own expertise.
- Wide range of services offered.

One Partner: SiliCycle

SiliCycle is devoted to serving their customers and constantly focuses on quality.

SiliCycle offers turnkey solutions based on its long expertise. Our main priority is to ensure you real innovation, tangible ROI, quality assurance and intellectual property within your tight timeframes. Our programs focus on issues of strategic importance for your venture: a unique value proposition to deliver results of high impacts.

Our flexible approach for each project brings added value to our services to match each client's requirements.

Our business models:

- Full Time Equivalent (FTE)
- Fee for Service (FFS)
- Milestone Based



Facility and Lab Infrastructure

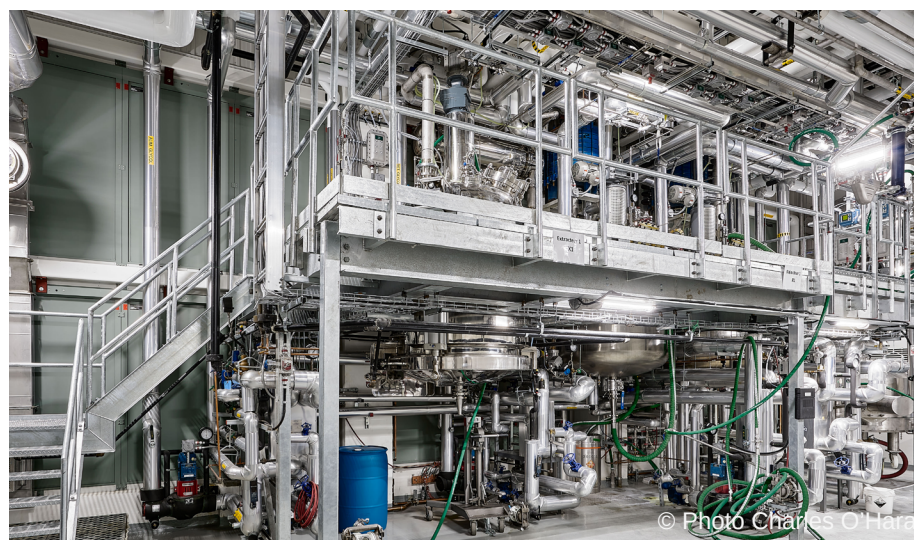
SiliCycle Headquarters is a new cutting-edge plant with a multi-ton scale manufacturing capability. With state-of-the-art instrumentation park in the areas of chromatography, spectroscopy, and manufacturing combined to an application support laboratory, we are devoted to extend your R&D and make your project a success.



As a certified ISO 9001:2015 company, we have a rigorous quality system implemented: all procedures and employees are in place to assure you ultimate quality and an unbeatable customer service.



Enjoy a virtual tour of SiliCycle's facility



© Photo Charles O'Hara

R&D Services Portfolio

Our R&D Services are categorized into 8 streams, and you can learn more about them throughout the next pages.

- Material Science Services
- Metal and Organic Scavenging Screening Services
- Organic Synthesis Services
- Catalysis Services
- Process Services
- Chromatography and Purification Services
- Method Development, Optimization and Transfer
- Analytical Laboratory Services



Metal and Organic Scavenging Screening Services

Our scavenging screening services provide solutions to quickly develop the most efficient metal scavenging process providing both time and cost savings. Confidentiality is assured and we will be working with you, in function of your needs



Batch: Lab and Process Development

Step 1: Screening

- Different SiliaCarb activated carbons and SiliaMetS metal scavengers will be tested on the crude product at two different temperatures.
- Influence of contact time will also be evaluated.

Step 2: Optimization

- After this initial screening, we will select the most efficient carbon and scavenger to optimize the ratio vs the API.
- Pairwise combinations of metal scavengers could also be tested, if satisfactory results are not obtained. Scavenging yields as well as recoveries will be evaluated.

Step 3: Scale-up Confirmation and Optimization

- A new amount of crude product will then be treated with SiliaCarb (if relevant), using the best obtained conditions to get enough product to work on the next step.
- Finally, we will test the best conditions on the API solubilized in two other solvent systems (depending on API solubility and customer's requirement). Scavenging yields as well as recoveries will be evaluated.
- Best conditions will be transposed on larger scale (to be determined based on the remaining crude product).

Batch to E-PAK: Including E-PAK Process Development

Includes all points performed with "batch" service plus the following:

- SiliaCarb and SiliaMetS best conditions will be transferred to E-PAK radial flow cartridges.
- Contact time's effect can be evaluated as well as parameter's optimization on E-PAK for both SiliaCarb and SiliaMetS.
- Scalability study based on customer final equipment can be performed if enough crude is available.

→ Main objective is to **accelerate research, optimize production costs**, while remaining fully in compliance with **new regulations and environmental challenges**

→ Scavenging strategies imply **lower volumes of solvent and higher yields** by minimizing loss of product via classical purification processes

Organic Synthesis and Catalysis Services

SiliCycle has a wide experience in the design and synthesis of new organic molecules and the development of novel methodology for their preparation. In especially challenging synthetic pathways, we can help you out with your most difficult reactions, using cutting-edge technology to develop cost-effective solutions.

Available Technologies

- Flow chemistry
- High-pressure chemistry
- Microwave-assisted reaction
- Parallel synthesis and purification

Typical Organic Chemistry Reactions

- Debenzylation, hydrogenation, oxidation, and reduction
- Reductive amination
- Couplings (*Suzuki*, *Sonogashira*, *Stille*, *Negishi*, etc.)

Most Popular Organic Synthesis Services

- Synthesis of active compounds, building blocks and intermediates from mg to hundred-grams scale
- Synthetic route design, realization, and optimization
- Scale-up of existing or new reactions
- Setting up catalytic reactions with *SiliaCat*
- Designing tailor-made silica-supported catalysts
- Scavenging of residual metal catalyst

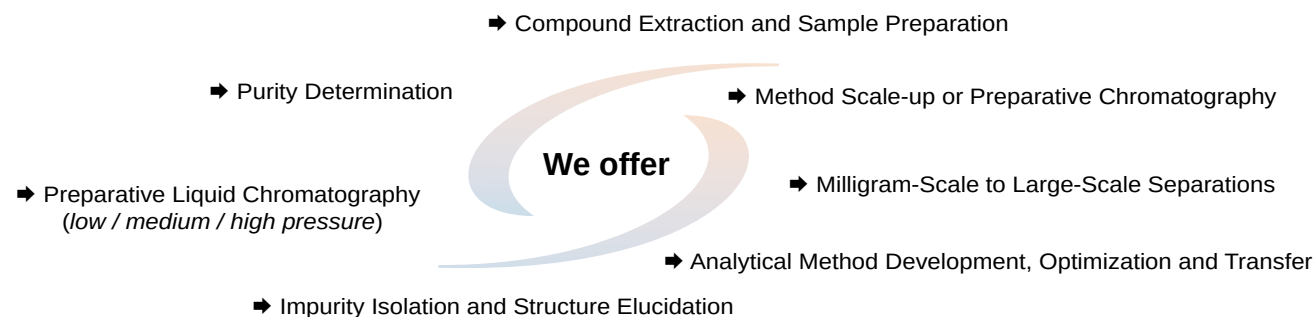
Areas of Chemical Expertise Include Synthesis of

- Analytical standards
- API's, impurities, and metabolites
- Building blocks and complex intermediates
- Chiral molecules
- Derivatives of lead compounds



Chromatography and Purification Services

For decades, SiliCycle has been dedicated to silica gel manufacturing and has built a strong skilled team in this field. You can now benefit from years of experience in chromatography, purification and method development. Our expertise covers a wide spectrum of applications on various purification scales.



Analytical Method Development, Optimization and Transfer

Our experts in method development, optimization and transfer can help you with your projects. You will benefit from our highly experienced team dedicated to develop or optimize methods in different matrices (*biological*, *food*, *beverages*, *water*, etc.) and for a wide range of molecules (*small to large*).

Our approach is flexible and can be customized to support your product development timeline. We work with you to establish the scope of the project and determine the most suitable factors to consider for the method development.

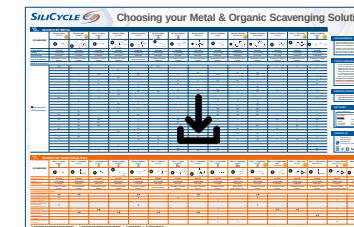
Method Development Considerations

- Molecular Structure:** functional groups, polarity, pKa, chirality, etc.
- Synthetic Route:** raw materials used, intermediates, possible by-products, isomers, etc.
- Sample Availability:** can be purchased, API, generated, etc.
- Separation Modes:** reversed-phases (*first mode screened*), normal, and hilic phases
- Detection Modes:** MS, ELSD, UV, Fluorescence, etc.
- Purity Assessment Methods:** HPLC, GC, NMR, etc.

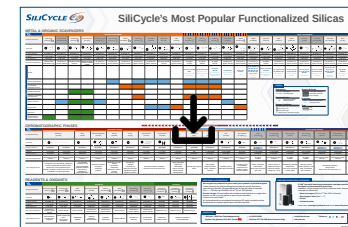


Resource Center

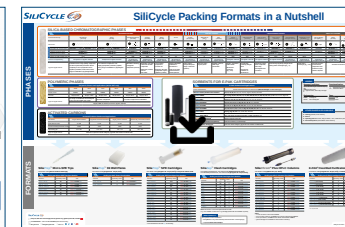
Download our Posters



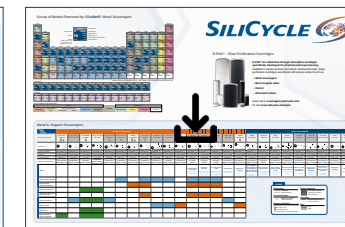
Choosing your metal & organic scavenging solution



SiliCycle's most popular functionalized silicas



SiliCycle packing formats in a nutshell



Functionalized silicas and reference information

Take a Look at some of our Multimedia Contents



Introduction to metal and organic Scavengers



Metal scavenging using bulk *SiliaMetS* functionalized silica



How to calculate the amount of scavenger needed



What are the parameters that influence scavenging efficiency?



E-PAK flow purification cartridges



Scale-up impurity scavenging with E-PAK



E-PAK cartridge housings, from lab to commercial scale



See how easy it is working with E-PAK



Flash separation of dye mixture with *SiliaSep* Premium



How does flash chromatography work?



Understanding Column Volume



What is the relationship between retention factor and column volume



The 5 steps of a solid phase extraction (SPE)



Understanding particle size distribution - D50, D90 and D10

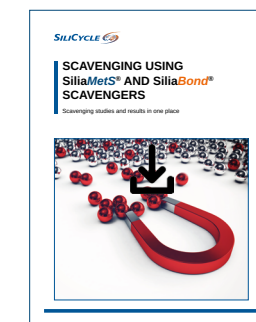


What pH range is suitable for functionalized silica?



What is the sample mass loading capacity of preparative TLC plates?

Get a Copy of our E-Books



A collection of various case studies and application notes using scavengers



A collection of scale-up case studies and application notes using scavengers

DISCOVER AND DOWNLOAD OUR BROCHURES

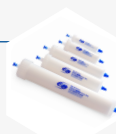
METAL AND ORGANIC SCAVENGING

SiliaMets® – Metal Scavengers
SiliaBond® – Organic Scavengers
E-PAK® – Fixed Bed Flow-Through Purification Cartridges



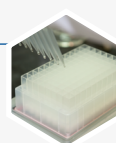
CHROMATOGRAPHY AND PURIFICATION

SiliaFlash® – Irregular Silica Gels | **SiliaSphere™ PC** – Spherical Silica Gels
SiliaBond® – Chromatographic Phases
SiliaSep™ – Flash Cartridges | **SiliaPlate™** – TLC Plates



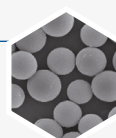
SAMPLE PREPARATION

SiliaPrep™ – Silica-based SPE Cartridges and Well Plates
SiliaPrepX™ – Polymeric SPE Cartridges and Well Plates



ANALYTICAL AND PREPARATIVE CHROMATOGRAPHY

SiliaSphere™ – Spherical Silica Gels
SiliaChrom® – HPLC Columns



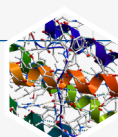
ORGANIC SYNTHESIS

SiliaBond® – Reagents and Oxidants
SiliaCat® – Heterogeneous Catalysts



PEPTIDE SYNTHESIS

Peptide Synthesis and Purification Solutions
Amine Free Basing and TFA Removal



R&D SERVICES

Metal and Organic Scavenging Screenings | Organic Synthesis
Chromatography and Purification | Material Science
Method Development, Optimization, and Transfer



Technical Support

At SiliCycle, we are committed to providing the best technical support possible.

Our worldwide Technical Support Group of highly qualified M. Sc., Ph. D. Chemists and Engineers will answer your questions and provide solutions to your most advanced chemistry and purification needs. Contact us at support@silicycle.com or call us.



SiliCycle Inc.
2500, Parc-Technologique Blvd,
Quebec City (Quebec) G1P 4S6
CANADA 

Phone: +1 418.874.0054
Toll Free **+1 877.745.4292** (North America only)
Fax: +1 418.874.0355

Email: info@silicycle.com

Website: www.silicycle.com

Follow us:     

Overseas Offices

SiliCycle Europe
europe@silicycle.com

+33 1 87 65 06 57

SiliCycle India
india@silicycle.com

SiliCycle Shanghai
contact@silicyclechina.com