



# SiliaChrom<sup>®</sup>

## HPLC Columns



Distributed by

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# SiliaChrom HPLC Columns

Using SiliaChrom HPLC Columns in chromatographic applications ensures the following:

- Excellent column efficiency
- Long lifetime and column-to-column reproducibility
- Broad pH range from 0.8 to 12
- Compatibility with 100% aqueous and organic mobile phases
- High surface coverage presenting no bleeding for LC-MS applications



## Presentation of the SiliaChrom HPLC Column Series

SiliCycle manufactures a variety of HPLC columns for reversed and normal phase applications. The SiliaChrom series contain more than 40 different phases, and we continue to develop additional, unique and powerful HPLC sorbents. Most of the SiliaChrom products are based on silica. You can be assured of the quality, from raw material synthesis through to the packing process.

We pack bonded phases in a wide range of column dimensions, including standard narrowbore and analytical columns in lengths of 30 to 250 mm, internal diameters of 2.0-4.6 mm, with particle sizes of 2.5, 3.0, 5.0 or 10.0  $\mu\text{m}$ . Also, preparative and semi-preparative HPLC columns are available, in 10, 20, 30 and 50 mm ID with lengths of 50, 100, 150 and 250 mm with particle sizes of 5 and 10  $\mu\text{m}$ . This new product line is designed for the most popular HPLC applications. These columns exhibit superior

performance for any type of compound. The SiliaChrom series, with its unique sol-gel process technology, offers the total solution for HPLC end-users: broad pH range (0.8 - 12), compatibility with 100% aqueous and organic mobile phases, low bleeding for LC-MS, high surface coverage, and excellent column efficiency. All columns are packed using a consistent slurry packing process to achieve an uniform and stable bed for long lifetime and column-to-column reproducibility.



## SiliaChrom HPLC columns

### How to build your Part Number

SiliaChrom HPLC columns are available in Narrow Bore, Analytical, Semi-Preparative, and Preparative formats.

Here is an example of a SiliaChrom product number that shows you the way they are structured;

The product numbers start with the **phase** code, followed by the **particle size**, the **pore size**, the **internal diameter**, and finally the **length** codes.

Note: For Guard Columns, add the letter "G" between the "H" and the phase code.

#### Example;

SiliaChrom AQ C18, 3  $\mu\text{m}$ , 100  $\text{\AA}$ , 4.6 mm x 150 mm = H151803E-N150

Particle Size		Pore Size		Internal Diameter			Column Length	
$\mu\text{m}$	Code	$\text{\AA}$	Code	Type of Columns	mm	Code	mm	Code
2.5	02	100	E	Narrow Bore	2.1	G	10	010
3.0	03	120	G	Narrow Bore	3.0	H	20	020
5.0	05	150	H	Analytical	4.6	N	30	030
7.0	06	300	M	Semi-Preparative	10	Q	50	050
10	07			Preparative	20	Y	100	100
20	09			Preparative	30	V	150	150
				Preparative	50	W	200	200
				Preparative	100	X	250	250

Particle Size

Pore Size

Internal Diameter

Column Length

\*You may also find and buy your SiliaChrom online at [www.silicycle.com/products/siliachrom-hplc-columns](http://www.silicycle.com/products/siliachrom-hplc-columns)



## SiliaChrom HPLC column Characteristics

SiliaChrom	Pore size (Å)	Particle size (µm)	Specific Surface area (m <sup>2</sup> /g)	Carbon Load (%)	pH range	UPS Code	T Limit* (°C)	Pressure Limit (psi)	Phase Code
SiliaChrom AQ C18	100	3, 5, 10	380	18	1.5 - 9.0	L01	60	5,000	H1518
SiliaChrom AQ C8	100	3, 5, 10	380	14	1.5 - 8.5	L07	60	5,000	H1508
SiliaChrom dt C18	100	2.5, 3, 5, 10	410 - 440	18	1.5 - 9.0	L01	60	5,000	H1418
SiliaChrom dt Si	100	2.5, 3, 5, 10	410 - 440	NA	1.0 - 8.0	L03	45	4,500	H1418
SiliaChrom XT C18	150	5, 10	200	15	1.5 - 12.0	L01	60	5,000	H1718
SiliaChrom XT Fidelity C18	100	3, 5, 10	380	21	1.5 - 12.0	L01	60	5,000	HF1718
SiliaChrom SB C18	150	3, 5, 10	200 - 220	12	0.8 - 7.5	L01	60	4,500	H1018
SiliaChrom SB C18-300	300	3, 5, 10	80	5	0.8 - 7.5	L01	60	4,500	H1018
SiliaChrom SB C8	150	3, 5, 10	200 - 220	7	1.0 - 7.5	L07	60	4,500	H1008
SiliaChrom SB C8-300	300	3, 5, 10	80	3	1.0 - 7.5	L07	60	4,500	H1008
SiliaChrom XDB C18	150	3, 5, 10	200	15	1.5 - 9.0	L01	60	5,500	H1118
SiliaChrom XDB C8	150	3, 5, 10	200	8	1.5 - 9.0	L07	60	5,500	H1108
SiliaChrom XDB Si	150	3, 5, 10	200	NA	1.0 - 8.0	L03	45	4,000	H1100
SiliaChrom XDB1 C18	100	3, 5, 10	380 - 400	22	1.5 - 10.0	L01	60	5,500	H1218
SiliaChrom XDB1 C18-300	300	3, 5, 10	80	8	1.5 - 9.0	L01	60	5,500	H1218
SiliaChrom XDB1 C8	100	3, 5, 10	380 - 400	14	1.5 - 8.5	L07	60	5,500	H1208
SiliaChrom XDB1 C8-300	300	3, 5, 10	80	4	1.5 - 8.5	L07	60	5,500	H1208
SiliaChrom XDB1 C4	100	3, 5, 10	380 - 400	7	1.5 - 8.5	L26	60	5,500	H1204
SiliaChrom XDB1 C4-300	300	3, 5, 10	80	3	2.0 - 8.0	L26	60	5,500	H1204
SiliaChrom XDB1 C1	100	3, 5, 10	380 - 400	3	1.5 - 8.5	L13	60	5,500	H1201
SiliaChrom XDB1 C1-300	300	3, 5, 10	80	1	2.0 - 8.0	L13	60	5,500	H1201
SiliaChrom XDB1 CN	100	3, 5, 10	380 - 400	5	2.0 - 8.5	L10	60	5,500	H1220
SiliaChrom XDB1 CN-300	300	3, 5, 10	80	3.5	2.0 - 8.0	L10	60	5,500	H1220
SiliaChrom XDB1 Amino	100	3, 5, 10	380 - 400	7	2.0 - 8.5	L08	45	5,500	H1260
SiliaChrom XDB1 Amino-300	300	3, 5, 10	80	3.5	2.0 - 8.0	L08	45	5,500	H1260
SiliaChrom XDB1 Phenyl	100	3, 5, 10	380 - 400	12	1.5 - 9.0	L11	60	4,000	H1240
SiliaChrom XDB1 Phenyl-300	300	3, 5, 10	80	4.5	2.0 - 8.0	L11	60	4,000	H1240
SiliaChrom XDB1 Diol	100	3, 5, 10	380 - 400	5	2.0 - 8.0	-	45	4,000	H1250
SiliaChrom XDB1 Diol-300	300	5, 10	380 - 400	1	2.0 - 8.0	-	45	4,000	H1250
SiliaChrom XDB1 Si	100	3, 5, 10	380 - 400	NA	1.0 - 8.0	L03	45	4,000	H1223
SiliaChrom XDB1 Si-300	300	3, 5, 10	80	NA	2.0 - 8.0	L03	45	4,000	H1223
SiliaChrom XDB2 C18	100	3, 5, 10	380	18	1.5 - 9.0	L01	60	5,000	H1318
SiliaChrom SCX	100	3, 5, 10	380	10	2.0 - 8.5	L09	45	5,000	H1800
SiliaChrom SCX-300	300	5, 10	80	3.5	2.0 - 8.0	L09	45	5,000	H1800
SiliaChrom SAX	100	3, 5, 10	380	6	2.0 - 8.5	L14	45	5,000	H1900
SiliaChrom SAX-300	300	5, 10	80	1	2.0 - 8.0	L14	45	5,000	H1900
SiliaChrom HILIC	100	3, 5, 10	380	8	2.0 - 8.0	-	60	5,000	H1600
SiliaChrom HILIC-300	300	3, 5, 10	80	2.5	2.0 - 8.0	-	60	5,000	H1600

\*At pH range 5.0 - 7.5



## Cross-References SiliaChrom HPLC columns

Cross-References SiliaChrom HPLC Columns		
SiliCycle HPLC Column	Applications	Equivalent to the commercial phase:
SiliaChrom AQ C18	Ideal for analytes that require more than 90% of water ( <i>Buffer</i> )	Zorbax SB Aq, Atlantis dC18, YMC-PACK ODS-AQ
SiliaChrom dt C18	Universal C18 for most popular applications ( <i>highest purity of silica gel</i> )	Inertsil ODS-3, Atlantis T3
SiliaChrom XT C18	Excellent durability for high pH Ideal for basic compounds	Gemini, Waters Xterra C18
SiliaChrom XT Fidelity C18	Excellent durability to high pH. Ideal for very polar analytes	Waters X-Bridge C18
SiliaChrom SB C18	Ideal for MS and ELSD of neutral to slightly polar analytes	Zorbax SB C18
SiliaChrom SB C8	Selectivity and peak shape similar to Zorbax SB C8	Zorbax SB C8
SiliaChrom XDB C18	Ideal for barbiturates, fat-soluble vitamins, fatty acids, steroids	Zorbax XDB C18, Discovery C18
SiliaChrom XDB C8	Selectivity and peak shape similar to Zorbax XDB C8	Zorbax XDB C8, Discovery C8
SiliaChrom XDB1 C18	Hydrophobic C18 phase suitable for analysis of wide range of compounds	Luna C18, Ascentis C18, Symmetry C18, Alltima HP C18 HiLoad
SiliaChrom XDB1 C8	Selectivity and peak shape similar to Sunfire C8, Luna C8 and Ascentis C8	Sunfire C8, Luna C8, Ascentis C8, Symmetry C8
SiliaChrom XDB1 CN	Excellent for basic pharmaceuticals, steroids and other basic compounds	Luna CN, Zorbax SB CN
SiliaChrom XDB1 Amino	Superior general purpose amino phase. Ideal for carbohydrates	Luna NH <sub>2</sub>
SiliaChrom XDB1 Phenyl	Ideal for polynuclear aromatic hydrocarbons, putines and polar aromatics	Zorbax SB Phenyl
SiliaChrom XDB1 Diol	Excellent for normal phase applications with more hydrophobic activity	Nucleosil Diol, Luna Diol
SiliaChrom XDB1 Si	Ideal for normal phase applications	Luna Silica
SiliaChrom XDB2 C18	Perfect peak symmetry for acidic, basic and neutral compounds	Luna C18 (2), Sunfire C18
SiliaChrom SCX	Ideal for charged analytes	Luna SCX
SiliaChrom SAX	Ideal for charged analytes	Agilent SB-SAX
SiliaChrom HILIC	Ideal for MedChem laboratories Isolation of very polar analytes	Unique



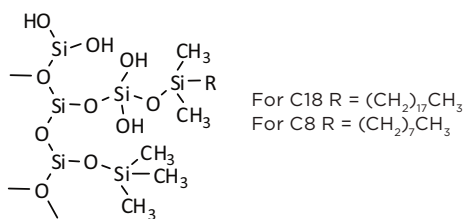
## SiliaChrom AQ C8 and AQ C18

### Description

Universal 100% aqueous-compatible HPLC columns

**SiliaChrom AQ** adsorbents present an optimum ratio of C18 (C8) short TMS chains and some free silanol groups. This new technology shows good peak shapes for any type of molecule (*acid, neutral and base*).

### Structure



SiliaChrom AQ C18

SiliaChrom AQ C8

### Sorbent Characteristics

- Pore Size: 100 Å
- Specific Surface Area: 380 m<sup>2</sup>/g
- Particles Sizes Available: 3, 5 and 10 μm
- Typical Carbon Loading: SiliaChrom AQ C18 18%  
SiliaChrom AQ C8 14%

### SiliaChrom AQ Main Characteristics

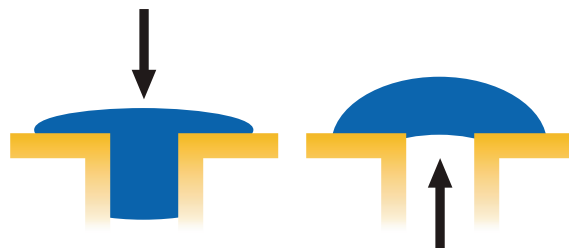
- Exceptional stability at pH 1.5 to 9.0
- Inertness for acidic and basic analytes
- Compatible from 100% aqueous mobile phase to 100% organic
- Rapid equilibration
- Reduced need for mobile phase modifiers
- Partially endcapped

## Dewetting Phenomena

The dewetting phenomena is the formation of drops on the solid surface caused by hydrophobic repulsions of the highly hydrophobic sorbents. This phenomena is illustrated, shown by the following scheme.

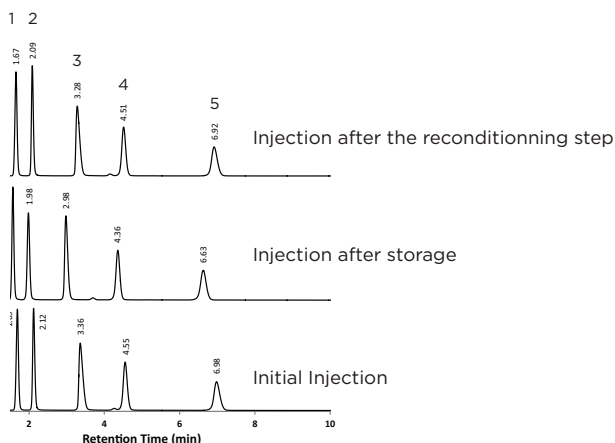
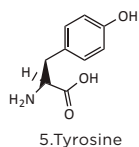
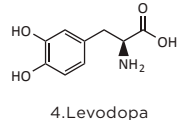
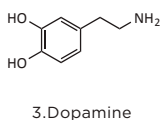
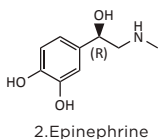
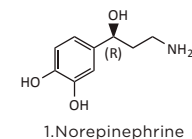
### General procedure

- The mixture of catecholamines is eluted on the column
- The flow is then stopped
- The column is stored in this condition during 18 h
- The mixture is then re-injected after a reconditioning step



### Chromatographic conditions

- **Column:** SiliaChrom AQ C18, 5 μm
- **Column size:** 4.6 x 150 mm
- **SiliCycle P/N:** H151805E-N150
- **Mobile phase:** 1% AcOH in water
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 265 nm
- **Injection volume:** 5 μL



A small decrease in retention time is observed, but is not significant. The displacement has been resolved after the reconditioning step. The SiliaChrom AQ C18 does not present the dewetting phenomena.





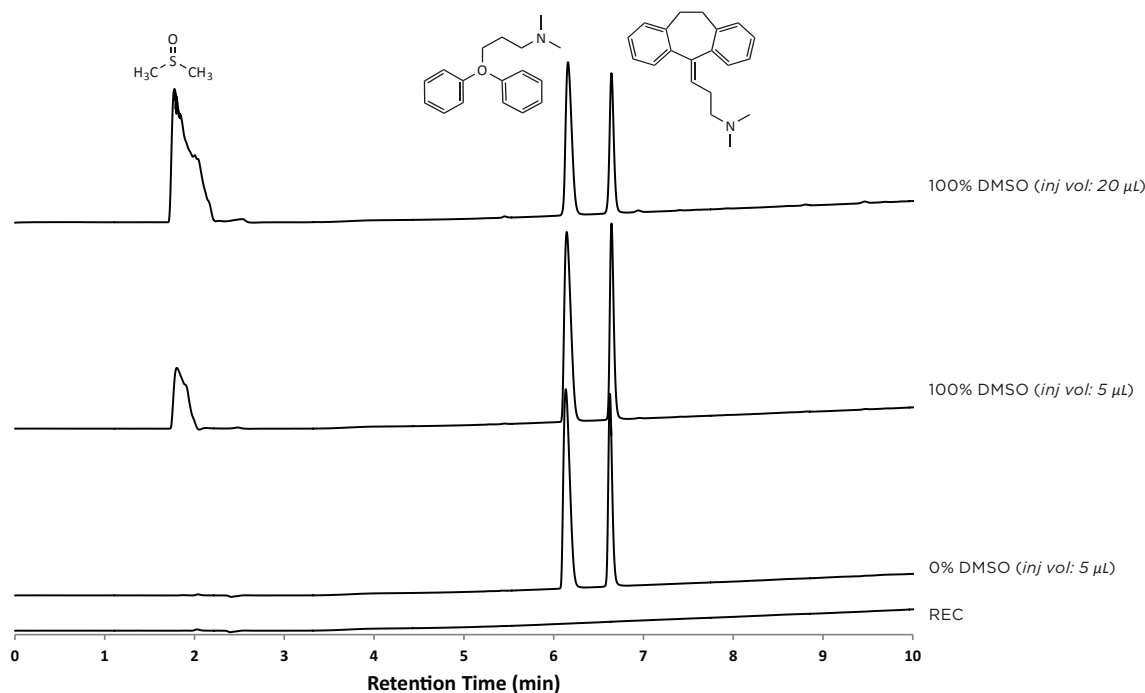
## Retention Capacity of DMSO on SiliaChrom AQ C18

DMSO (*DimethylSulfoxide*) is an excellent solvent to solubilize most compounds. Unfortunately, this solvent is not volatile and in some C18 columns the DMSO can interact with the stationary phase and create a loss of selectivity. In this case, the only way to inhibit this effect is to use preparative chromatography. In this study, we show that DMSO does not interact with our SiliaChrom AQ C18. For this study, a linear gradient has been used from a highly aqueous mobile phase to a highly organic phase.

### Chromatographic conditions

- **Column:** SiliaChrom AQ C18, 5  $\mu\text{m}$
- **Column size:** 4.6 x 150 mm
- **SiliCycle P/N:** H151805E-N150
- **Mobile phase:** MPA 0.1% formic acid in water  
MPB 0.1% formic acid in ACN
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Reconstitution solution (REC):** DMSO

Gradient		
Time (min)	% MPA	% MPB
0	90	10
9	10	90
10	10	90
11	90	10



### Statistic Analysis Results

Conditions	As <sub>DMSO</sub>	Tr <sub>DMSO</sub> (min)	K' <sub>DMSO</sub>	W <sub>DMSO</sub>	Tr <sub>diphenhydramine</sub> (min)	Tr <sub>amitriptyline</sub> (min)
0% DMSO 5 $\mu\text{L}$	-	-	-	-	6.14	6.63
100% DMSO 5 $\mu\text{L}$	2.29	1.80	0.09	0.3	6.15	6.64
100% DMSO 20 $\mu\text{L}$	4.10	1.78	0.08	0.5	6.16	6.64

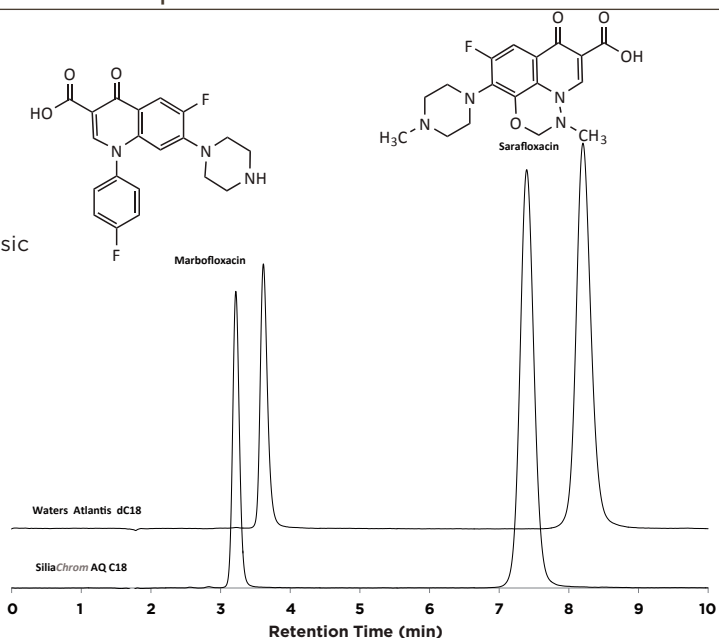
**Conclusion:** The study shows that DMSO does not interact with the SiliaChrom AQ C18. No specific retention is observed. The SiliaChrom AQ C18 is an excellent choice to purify components contaminated with DMSO.

## Peak Shape Evaluation for Zwitterion Fluoroquinolones

High separation power for zwitterion analysis.

### Chromatographic conditions

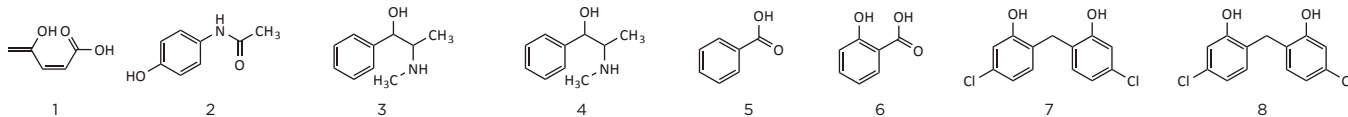
- **Column:** SiliaChrom AQ C18, 5  $\mu\text{m}$
- **Column size:** 4.6 x 150 mm
- **SiliCycle P/N:** H151805E-N150
- **Mobile phase:** 2.5 mM potassium phosphate monobasic (adjust to pH 2.5 with  $\text{H}_3\text{PO}_4$ )/ethanol (68/32)
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 275 nm
- **Injection volume:** 10  $\mu\text{L}$



Peak Shape Results		
Product	Asymmetry (USP) SiliaChrom AQ C18	Asymmetry (USP) Atlantis dC18
Marbofloxacin	1.12	1.29
Sarafloxacin	1.09	1.14

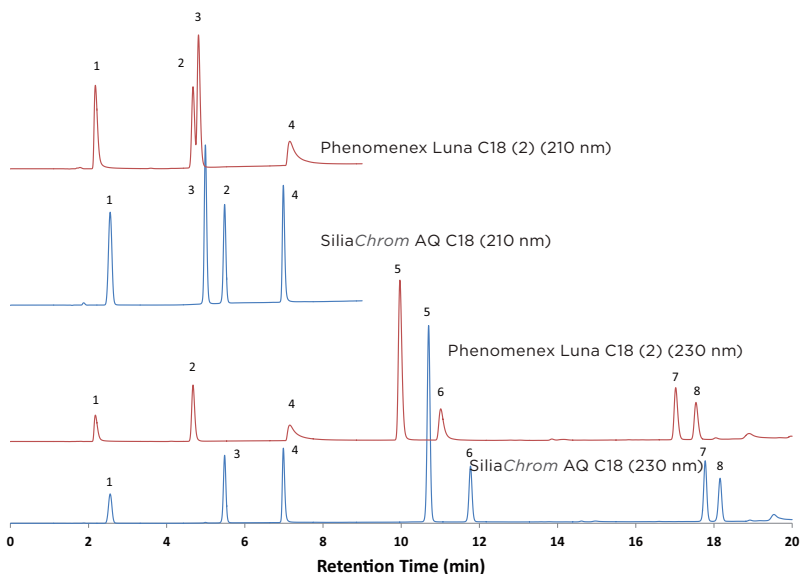
## Evaluation of Resolution and Peak Shape

The AQ C18 column is universal, efficient even for mixtures of basic and acidic compounds.



### Chromatographic conditions

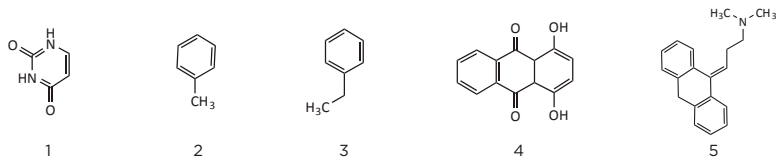
- **Column:** SiliaChrom AQ C18, 5  $\mu\text{L}$   
Phenomenex Luna, C18 5  $\mu\text{L}$
- **Column size:** 4.6 x 150 mm
- **SiliCycle P/N:** H151805E-N150
- **Mobile phase:** MPA: 5 mM potassium phosphate monobasic (adjust to pH 2.5 with  $\text{H}_3\text{PO}_4$ )/ACN (90/10)  
MPB: 5 mM potassium phosphate monobasic (adjust to pH 2.5 with  $\text{H}_3\text{PO}_4$ )/ACN (10/90)
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Injection volume:** 5  $\mu\text{L}$





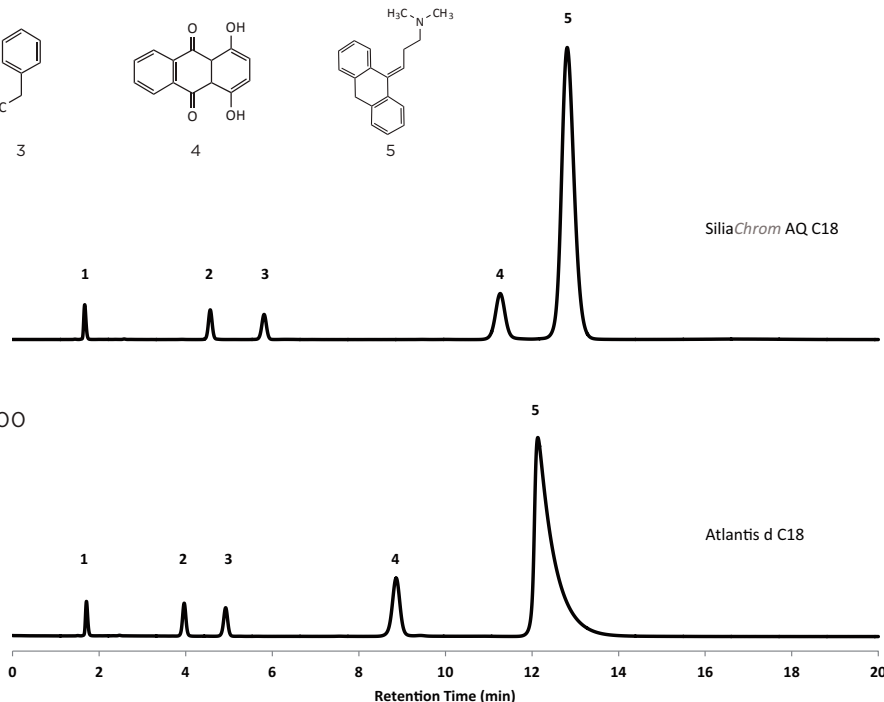
## SiliaChrom AQ C18 for Basic Compounds

Amitriptyline, a strong basic compound, can be adsorbed on residual silanols on the surface of the packing material. With the traditional endcapping technique, this results in poor peak shapes. SiliCycle has developed a new method of silanol deactivation to eliminate the peak tailing from adsorption of compounds on residual silanol groups. This enables highly qualitative and quantitative analysis of strong basic compounds.



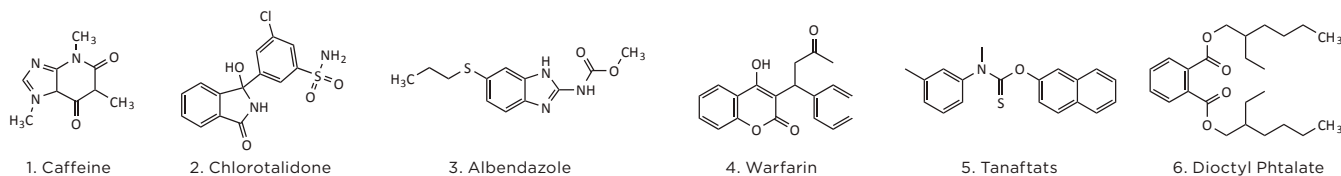
### Chromatographic conditions

- **Column:** SiliaChrom AQ C18, 5  $\mu\text{m}$
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: H151805E-N150
- **Mobile phase:** 80/20 methanol/  
20 mM potassium phosphate pH 7.00
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Injection volume:** 1  $\mu\text{L}$



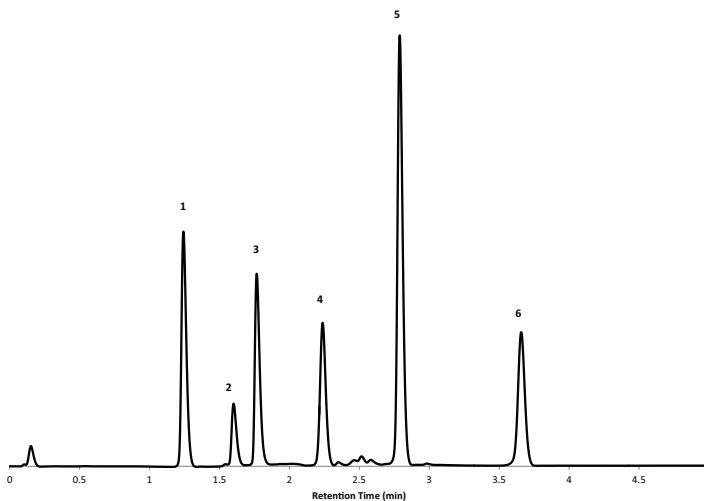
## Rapid HPLC with SiliaChrom AQ C18 - Multi-Component Sample

Indispensable for pharmaceutical quality control, conjugate efficiency and rapidity.



### Chromatographic conditions

- **Column:** SiliaChrom AQ C18, 5  $\mu\text{m}$
- **Column size:** 3.0 x 30 mm  
SiliCycle P/N: H151805E-H030
- **Mobile phase:**  
MPA: 0.1% TFA in ACN/water (5/95)  
MPB: 0.1% TFA in ACN/water (95/5)  
Linear gradient: MPA to MPB, 2.25 minutes
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Injection volume:** 5  $\mu\text{L}$



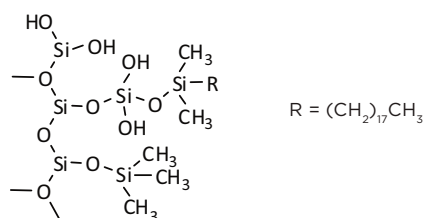
## SiliaChrom dt C18

### Description

Universal 100% aqueous compatible HPLC columns.

The modified surface chemistry of **SiliaChrom AQ** and **SiliaChrom dt** columns is identical but the silica framework does not present any metals in the dt sorbent.

### Structure



**SiliaChrom AQ purity:** 99.999% SiO<sub>2</sub>

**SiliaChrom dt Purity:** 99.9999% SiO<sub>2</sub>  
(no metal content)

**SiliaChrom dt C18**

### Sorbent Characteristics

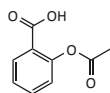
- **Pore Size:** 100 Å
- **Specific Surface Area:** 410 - 440 m<sup>2</sup>/g
- **Particle Sizes Available:** 2.5, 3, 5 and 10 μm
- **Typical Carbon Loading:** SiliaChrom dt C18 18%

### SiliaChrom dt Main Characteristics

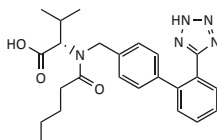
- **Enhances retention of hydrophilic molecules**
- **Low bleeding and high sensitivity for LC-MS**
- **Extremely low metal content level (< 10 ppm)**
- **Good tolerance for direct injection of biological matrix (dirty samples)**
- **Higher surface area**
- **Partially endcapped**

## Assay for QC Testing of Blood Pressure and Cholesterol Medication

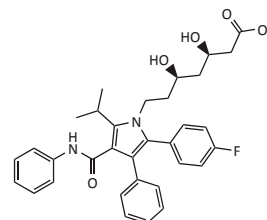
The SiliaChrom dt C18 presents a high lot-to-lot reproducibility, which makes it an excellent choice for quality control analysis in pharmaceutical laboratories.



A: Aspirine



B: Valsartan



C: Atorvastatin

### Chromatographic conditions

- **Column:** SiliaChrom dt C18, 5 μm
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: H141802E-N150
- **Mobile phase:**  
Methanol/H<sub>2</sub>O (70/30), 0.1% (v/v) formic acid
- **Temperature:** 30°C
- **Flow rate:** 0.800 mL/min
- **Detector:** UV at 280 nm
- **Injection volume:** 10 μL





## Ropinirole and Amitriptyline Detection in Human Plasma

SiliaChrom dt C18 presents low bleeding and is excellent for dirty samples. Partial endcapping allows for some interactions with free silanol groups. The use of SiliaPrep CleanDRUG prior to injection onto the column insure a very clean sample witch results in very low ionic suppression when using in LC-MS/MS analysis. Another big advantage is the high selectivity of SiliaChrom dt C18 at all concentration levels.

### Chromatographic conditions

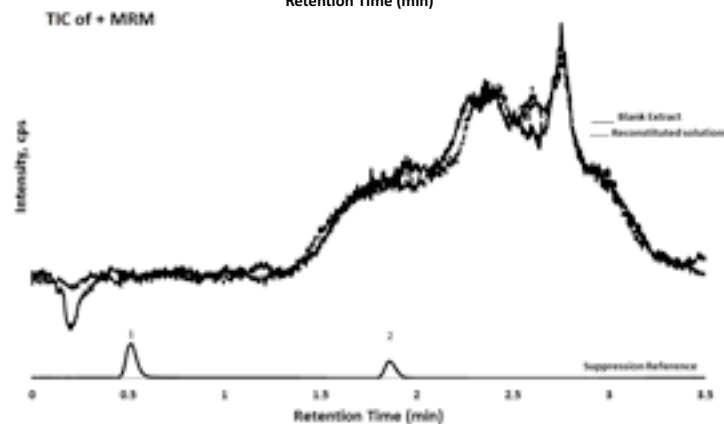
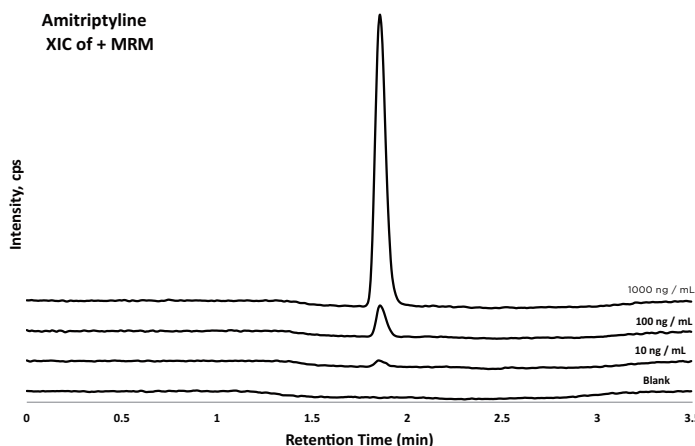
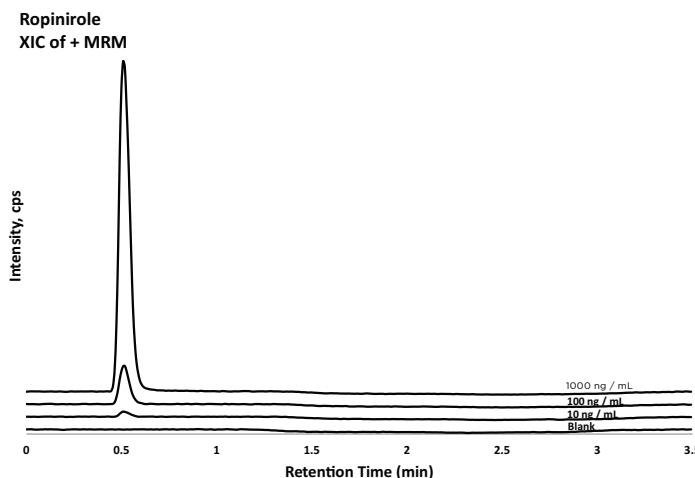
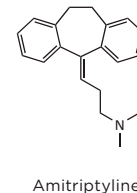
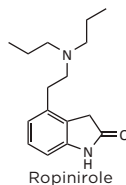
- **Column:** SiliaChrom dt C18, 2.5  $\mu\text{m}$
- **Column size:** 3.0 x 30 mm  
SiliCycle P/N: H141802E-H030  
Sample prepared by SPE  
SiliaPrep CleanDRUG 3 mL/500 mg  
PN: SPEC-R651230B-03G
- **Mobile phase:**  
MPA: 1 mM ammonium formate in (ACN/water, 10/90), 0.1% formic acid (v/v)  
MPB: 1 mM ammonium formate in (ACN/water, 90/10), 0.1% formic acid (v/v)

Gradient			
Time (min)	MPA (%)	MPB (%)	Flow (mL/min)
0.00 - 0.20	85	15	1.000
0.21 - 1.20	50	50	1.000
1.21 - 1.60	0	100	1.000
1.61 - 3.50	85	15	1.000

- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **MS splitting flow:** 0.30 mL/min
- **Injection volume:** 5  $\mu\text{L}$

### Tandem mass spectroscopy conditions

- **Detector:** Sciex API 3000, Applied Biosystem
- **Ion Source:** Positive Electrospray (ESI+)
- **Turbolon Ion Spray heater gas flow:** 8000 cc/min
- **Turbolon Ion Spray heater temperature:** 375°C
- **MRM Transition:** Ropinirole: m/z (261.2  $\rightarrow$  114.2)  
Amitriptyline: m/z (278.4  $\rightarrow$  233.1)

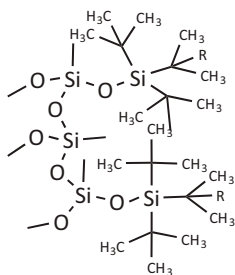


## SiliaChrom SB C18 and C8

### Description

**SiliaChrom SB C18 and C8** surfaces are treated with an organic form of silicon to increase the number of silanol groups on the surface. After this step, the surface is bonded with a silane containing two functions. One function is a protecting group that shields the area and protects the surface from an acid attack from the mobile phase. The ion  $\text{H}_3\text{O}^+$  does not have access to the surface to break the O-Si bond (*steric effect*). The other function is the linear hydrophobic chain with 18 or 8 carbons.

### Structure



For C18 R =  $(\text{CH}_2)_{17}\text{CH}_3$   
 For C8 R =  $(\text{CH}_2)_7\text{CH}_3$

**SiliaChrom SB C18**

**SiliaChrom SB C8**

### Sorbent Characteristics

- Pore Size: 100 Å
- Specific Surface Area: 200 - 220 m<sup>2</sup>/g
- Particle Sizes Available: 3, 5 and 10 μm
- Typical Carbon Loading: SiliaChrom SB C18 12%  
SiliaChrom SB C8 7%

### SiliaChrom SB Main Characteristics

- Extremely low pH limits (0.5 - 7.5)
- Extremely low bleeding for LC-MS applications under acidic conditions
- Compatible with mobile phases ranging 100% aqueous to 100% organic
- Non endcapped



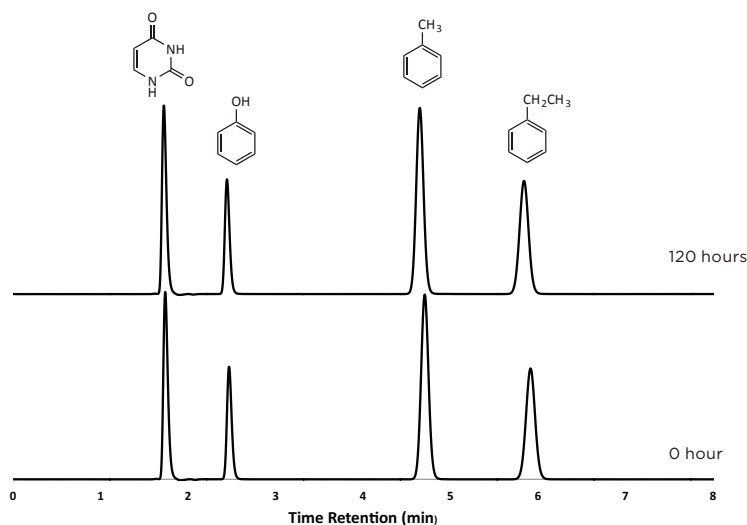


## Stability of SiliaChrom SB C18 at Low pH Conditions

Acidic mobile phases have widespread applications in the reversed phase HPLC separation of many important pharmaceutical and environmental compounds. Analytes such as pharmaceuticals and biomolecules often show peak shape, retention and selectivity changes when the mobile phase pH is changed from neutral to acidic pH ( $pH\ 1.0$ ). In fact, lowering the pH helps to suppress silanol interactions between basic compounds and the residual surface silanols, thus resulting in less tailing and better retention of acidic compounds ( $pK_a\ lower\ than\ 2$ ).

### Chromatographic conditions

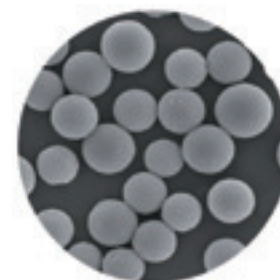
- **Column:** SiliaChrom SB C18, 5  $\mu m$
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: H101805H-N150
- **Mobile phase:** 2% TFA in ACN/water (60/40)  
Solution pH: 1.00
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 270 nm
- **Injection volume:** 10  $\mu L$



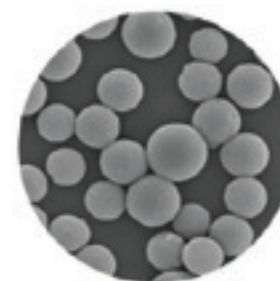
SiliaChrom SB C18 (Ethylbenzene)

Time (hour)	RT (min)	TF (USP)	N (USP)
0	5.91	1.01	14,014
24	5.89	1.02	14,085
48	5.77	1.02	14,023
72	5.83	1.02	14,076
96	5.85	1.01	14,087
120	5.84	1.02	14,050
Mean	5.85	1.02	14,056
RSD (%)	0.84	0.51	0.23

No column degradation under extreme pH conditions



SiliaChrom SB C18 before



SiliaChrom SB C18 after

The HPLC column was used under extreme pH conditions and, even after 5 days of continuous injections, the number of theoretical plates ( $N$ ), the tailing factor ( $TF$ ) and the retention times ( $RT$ ) are comparable. The sorbent kept its chemical and structural integrity, which we have proven with similar chromatograms and scanning electron microscope pictures ( $SEM$ ) before and after 120 hours of use.

In conclusion, our SiliaChrom SB C18 and SB C8 columns are stable at low pH conditions.

## SiliaChrom XT C18 and XT C18 Fidelity

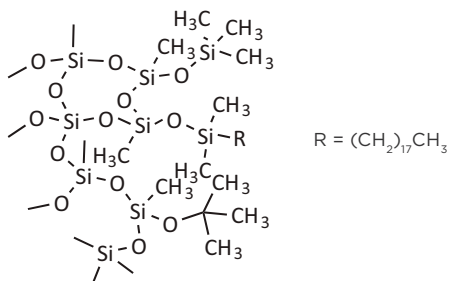
### Description

**SiliaChrom XT C18 and XT C18 Fidelity** are compatible with low or high pH conditions. The key is to have a hybrid surface to reduce the solubility of silica at high pH. In fact, the SiliaChrom XT C18 and the XT C18 Fidelity silica are coated with a monomeric methyltriethoxysilane/tetraethoxysilane prepolymer, followed by a special thermic treatment to get a rigid surface that is less soluble than untreated silica itself at high pH.

The SiliaChrom XT C18 column is designed for applications to be run at very high pH (*up to 12.0*) at room temperature but it is also suitable for low pH (*down to 1.5*).

The SiliaChrom XT C18 Fidelity is used at high pH conditions with a higher thermal stability. The only difference between SiliaChrom XT C18 and the XT C18 Fidelity is the way the HPLC column is packed (*proprietary information*) which gives more robustness at high pH and temperature.

### Structure



SiliaChrom XT C18 and XT C18 Fidelity

### Sorbent Characteristics

- Pore Size: 150 Å
- Specific Surface Area: 380 m<sup>2</sup>/g
- Particle Sizes Available: 3, 5 and 10 μm
- Typical Carbon Loading: SiliaChrom XT C18 15%  
SiliaChrom XT C18 Fidelity 21%

### SiliaChrom XT Main Characteristics

- Excellent durability at high pH (*up to 12*)
- Ideal for basic compounds
- High thermal stability
- Ideal for auto-purification (*Prep. LC-MS*)
- Double endcapped
- Best HPLC columns for either metabolic or metabolite studies

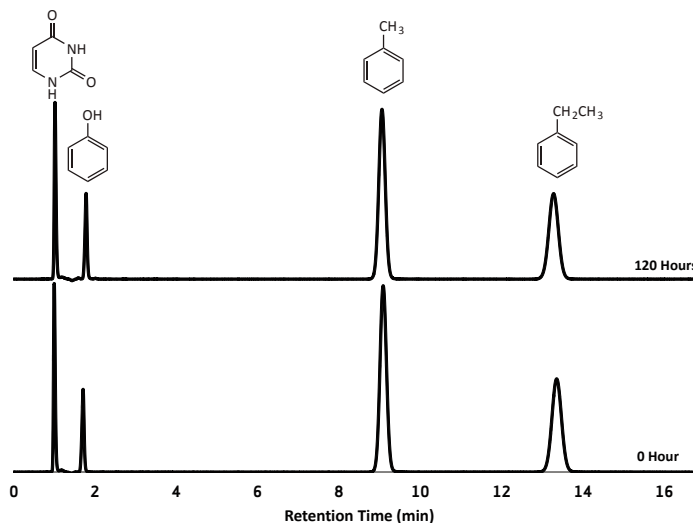


## Stability of SiliaChrom XT C18 Fidelity at High pH Conditions

For some applications, it is necessary to work at high pH to increase the selectivity or to optimize peak shape. This is the case with basic organic compounds ( $pK_a > 9.0$ ). It is the reason why it is important to have chromatographic phases stable at alkaline pH. This study demonstrates the stability of the SiliaChrom XT C18 Fidelity at high pH.

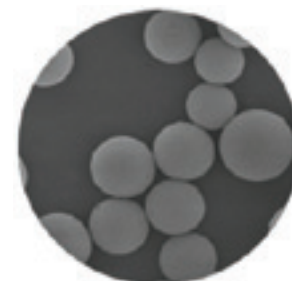
### Chromatographic conditions

- **Column:** SiliaChrom XT C18 Fidelity, 5  $\mu\text{m}$
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: HF171805H-N150
- **Mobile phase:** 0.2% TEA in ACN/water (55/45) (v/v)  
Solution pH: 11.5
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 270 nm

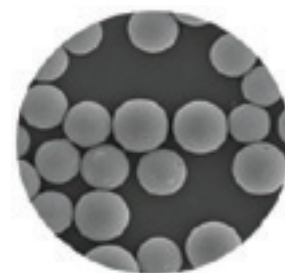


### SiliaChrom XT C18 Fidelity (Ethylbenzene)

Time (hour)	RT (min)	TF (USP)	N (USP)
0	13.35	1.01	13,623
24	13.29	1.01	13,648
48	13.27	1.01	13,689
72	13.25	1.00	13,604
96	13.24	1.00	13,649
120	13.28	1.00	13,582
Mean	13.28	1.01	13,633
RSD (%)	0.29	0.54	0.28



SiliaChrom XT C18 Fidelity before



SiliaChrom XT C18 Fidelity after

The HPLC column was used under extreme pH conditions, and even after 5 days of continuous injections, the number of theoretical plates ( $N$ ), the tailing factor ( $TF$ ) and the retention times ( $RT$ ) are comparable. The sorbent kept its chemical and structural integrity, which we have proven with similar chromatograms and scanning electron microscope ( $SEM$ ) pictures before and after 120 hours of use.

In conclusion, our SiliaChrom XT C18 Fidelity columns are stable at high pH conditions.

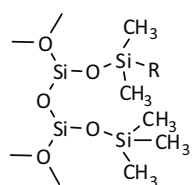
## SiliaChrom XDB C18 & XDB C8

### Description

**SiliaChrom XDB C18 and C8** are specially designed with a bigger pore size and lower surface area for the separation of large hydrophobic molecules. The relatively low surface area allows a shorter retention time for such compounds.

SiliaChrom XDB phases are ideal for separation of barbiturates, fat-soluble vitamins, fatty acids and steroids.

### Structure



For C18 R = (CH<sub>2</sub>)<sub>17</sub>CH<sub>3</sub>  
For C8 R = (CH<sub>2</sub>)<sub>7</sub>CH<sub>3</sub>

SiliaChrom XDB C18

SiliaChrom XDB C8

### Sorbent Characteristics

- Pore Size: 150 Å
- Specific Surface Area: 200 m<sup>2</sup>/g
- Particle Sizes Available: 3, 5 and 10 µm
- Typical Carbon Loading: SiliaChrom XDB C18 15%  
SiliaChrom XDB C8 8%

### SiliaChrom XDB C18 Main Characteristics

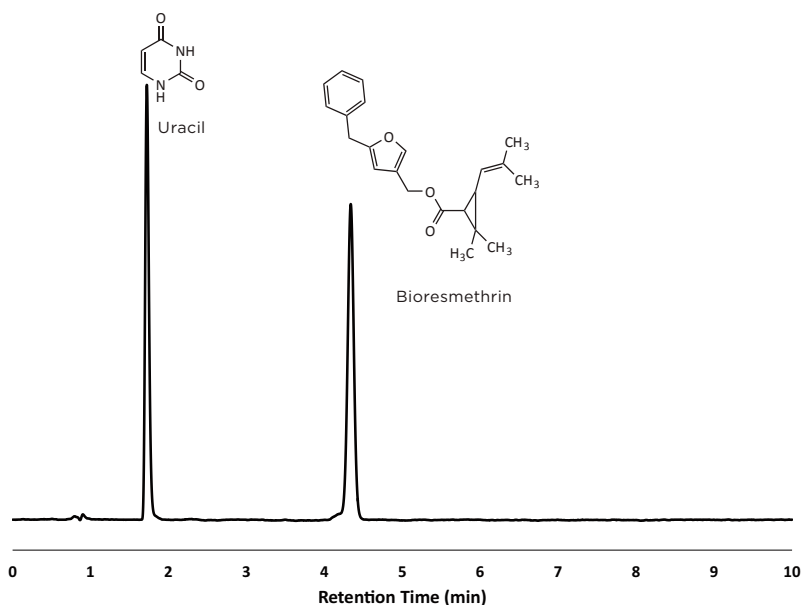
- Better choice for molecules > 500 Dalton
- High Loading capacity
- Wide pH range: 1.5 to 9.0
- Double endcapped

## Resolution and Peak Shape of a Highly Hydrophobic Domestic Insecticide

This application illustrates the high separation efficiency of the SiliaChrom XDB C18 for very hydrophobic compounds.

### Chromatographic conditions

- Column: SiliaChrom XDB C18, 5 µm
- Column size: 4.6 x 150 mm  
SiliCycle P/N: H111805H-N150
- Mobile phase: ACN/water (90/10)
- Temperature: 23°C
- Flow rate: 1.000 mL/min
- Detector: UV at 235 nm
- Injection Volume: 1 µL



### Column Performance Results

Compounds	Retention Time (min)	Peak Asymmetry Factor (USP)	Theoretical Plates (USP)
Uracil	1.72	1.26	5,936
Bioresmethrin	4.34	1.03	14,090



## SiliaChrom XDB1

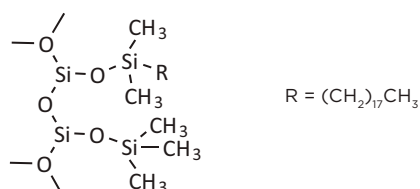
### Description

**SiliaChrom XDB1** phases have a wider range of polarity than other SiliCycle HPLC columns (*C18 to normal phase*). This phase has the maximum bonding density regardless of compound's polarity. This allows for the least amount of interaction between the analytes and the surface OH. This phase is not recommended for samples containing highly hydrophobic compounds.

All SiliaChrom XDB1 are available in 3, 5 and 10  $\mu\text{m}$  except the Diol-300 which is not available in 3  $\mu\text{m}$ .

The SiliaChrom XDB1 C18: Designed for maximum hydrophobicity and efficiency for dirty samples.

### Structure



SiliaChrom XDB1 C18

### Sorbent Characteristics

#### SiliaChrom XDB1 C18

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400  $\text{m}^2/\text{g}$
- Typical Carbon Loading: 22%
- pH Stability: 1.5 - 10.0

#### SiliaChrom XDB1 C18-300

- Pore Size: 300 Å
- Specific Surface Area: 80  $\text{m}^2/\text{g}$
- Typical Carbon Loading: 8%
- pH Stability: 1.5 - 9.0

### SiliaChrom XDB1 C8 and C18 Main Characteristics

- Better choice for molecules > 500 Dalton
- High Loading capacity
- Wide pH range: 1.5 to 10.0
- Double endcapped

## Highly Base Deactivated C18



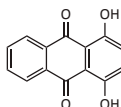
1. Uracil



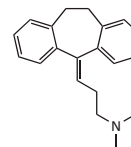
2. Toluene



3. Ethylbenzene



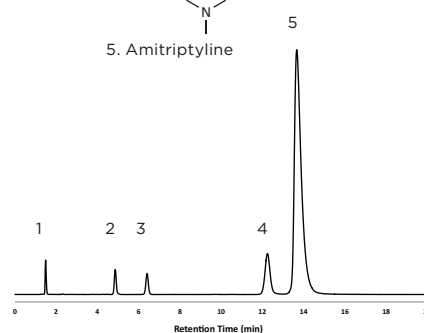
4. Quinizarin



5. Amitriptyline

### Chromatographic conditions

- **Column:** SiliaChrom XDB1 C18, 5  $\mu\text{m}$
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: H121805H-N150
- **Mobile phase:** MeOH/20 mM potassium phosphate monobasic  
pH = 7.00 (80/20)
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Injection Volume:** 1  $\mu\text{L}$



### Column Performance Results

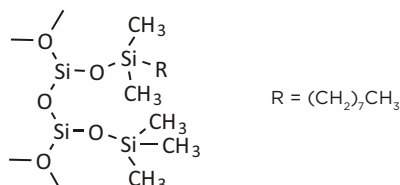
Compounds	Retention Time (min)	Peak Asymmetry Factor (USP)	Theoretical Plates (USP)
Uracil	1.49	1.27	3,778
Toluene	4.86	1.09	12,144
Ethylbenzene	6.40	1.02	13,026
Quinizarin	12.24	1.07	11,525
Amitriptyline	13.66	1.76	8,190

## SiliaChrom XDB1

### Description

**SiliaChrom XDB1 C8:** Exceptionally stable with high bonding coverage and low silanol activity.

### Structure



SiliaChrom XDB1 C8

### Sorbent Characteristics

#### SiliaChrom XDB1 C8

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 14%
- pH Stability: 1.5 - 10.0

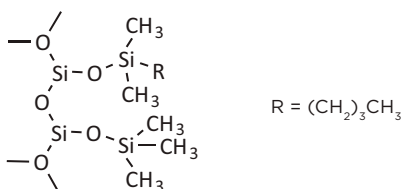
#### SiliaChrom XDB1 C8-300

- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 4%
- pH Stability: 1.5 - 8.5

### Description

**SiliaChrom XDB1 C4:** Exceptionally stable with high bonding coverage and low silanol activity

### Structure



SiliaChrom XDB1 C4

### Sorbent Characteristics

#### SiliaChrom XDB1 C4

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 7%
- pH Stability: 1.5 - 8.5

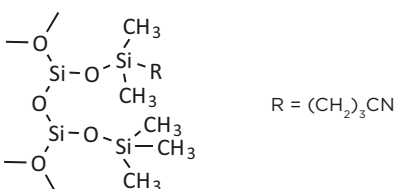
#### SiliaChrom XDB1 C4-300

- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 3%
- pH Stability: 2.0 - 8.0

### Description

**SiliaChrom XDB1 CN:** Maximum hydrophobicity and accepts normal and reversed phase conditions.

### Structure



SiliaChrom XDB1 CN

### Sorbent Characteristics

#### SiliaChrom XDB1 CN

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 5%
- pH Stability: 1.5 - 8.5

#### SiliaChrom XDB1 CN-300

- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 3.5%
- pH Stability: 2.0 - 8.0



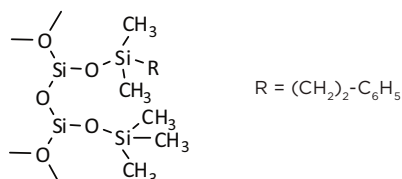


## SiliaChrom XDB1

### Description

**SiliaChrom XDB1 Phenyl:** Highly retentive phase for aromatic and unsaturated compounds.

### Structure



SiliaChrom XDB1 Phenyl

### Sorbent Characteristics

#### SiliaChrom XDB1 Phenyl

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 12%
- pH Stability: 1.5 - 9.0

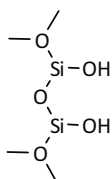
#### SiliaChrom XDB1 Phenyl-300

- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 4.5%
- pH Stability: 2.0 - 8.0

### Description

**SiliaChrom XDB1 Si:** Designed for normal phase conditions, presents high surface area and low metal content.

### Structure



SiliaChrom XDB1 Si

### Sorbent Characteristics

#### SiliaChrom XDB1 Si

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- pH Stability: 1.0 - 8.0

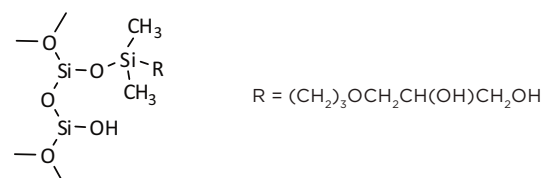
#### SiliaChrom XDB1 Si-300

- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- pH Stability: 1.0 - 8.0

### Description

**SiliaChrom XDB1 DIOL:** Excellent for normal phase applications with more hydrophobic activity.

### Structure



SiliaChrom XDB1 Diol

### Sorbent Characteristics

#### SiliaChrom XDB1 DIOL

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 5%
- pH Stability: 2.0 - 8.0

#### SiliaChrom XDB1 DIOL-300

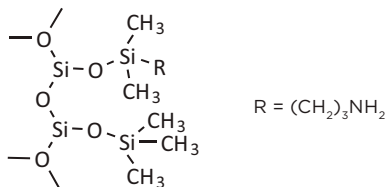
- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 1%
- pH Stability: 2.0 - 8.0

## SiliaChrom XDB1

### Description

**SiliaChrom XDB1 AMINO:** Superior general purpose amino phase. Recommended for normal phase analysis and excellent for sugar analysis.

### Structure



SiliaChrom XDB1 AMINO

### SiliaChrom XDB1 AMINO Main Characteristics

- Wide pH range
- High carbon loading
- Very stable for aggressive mobile phases
- Accepts large injection volume (*50  $\mu$ L and more*)
- Double endcapped

### Sorbent Characteristics

#### SiliaChrom XDB1 AMINO

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Typical Carbon Loading: 6%
- pH Stability: 2.0 - 8.5

#### SiliaChrom XDB1 AMINO-300

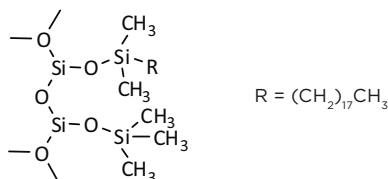
- Pore Size: 300 Å
- Specific Surface Area: 80 m<sup>2</sup>/g
- Typical Carbon Loading: 2.5%
- pH Stability: 2.0 - 8.0

## SiliaChrom XDB2 C18

### Description

**SiliaChrom XDB2 C18:** Designed to be a mid-hydrophobic C18 phase with 18% of carbon loading, like most of the popular reversed-phase HPLC columns on the market. This phase demonstrates a balanced hydrophobic adsorption in order to avoid excessive retention of hydrophobic compounds.

### Structure



SiliaChrom XDB2 C18

### Sorbent Characteristics

#### SiliaChrom XDB2 C18

- Pore Size: 100 Å
- Specific Surface Area: 380 - 400 m<sup>2</sup>/g
- Particle Sizes Available: 3, 5 and 10 μm
- Typical Carbon Loading: 18%
- pH Stability: 1.5 - 9.0

#### SiliaChrom XDB2 C18 Main Characteristics

- Great column-to-column and batch-to-batch reproducibility (*popular for QC/QA laboratory*)
- Typical average value for carbon loading (**18%**)
- Good peak shape for basic, acidic and neutral analytes
- Stronger separation power for isomers
- Double endcapped

## Highly Base Deactivated C18



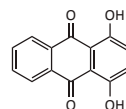
1. Uracil



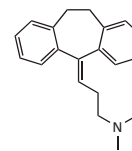
2. Toluene



3. Ethylbenzene



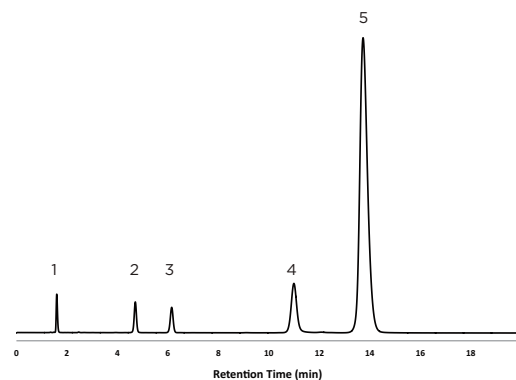
4. Quinizarin



5. Amitriptyline

### Chromatographic conditions

- **Column:** SiliaChrom XDB2 C18, 5 μm
- **Column size:** 4.6 x 150 mm  
SiliCycle P/N: H131805H-N150
- **Mobile phase:** MeOH/20 mM potassium phosphate monobasic  
pH = 7.00 (80/20)
- **Temperature:** 23°C
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm
- **Injection Volume:** 1 μL



### Column Performance Results

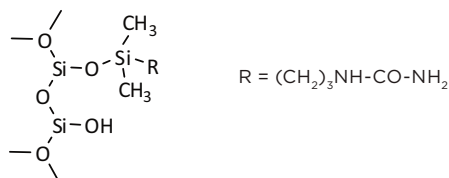
Compounds	Retention Time (min)	Peak Asymmetry Factor (USP)	Theoretical Plates (USP)
Uracil	1.61	1.24	4 618
Toluene	4.73	1.04	12 858
Ethylbenzene	6.19	1.00	13 633
Quinizarin	11.18	1.03	12 277
Amitriptyline	13.53	1.29	9 451

## SiliaChrom HILIC

### Description

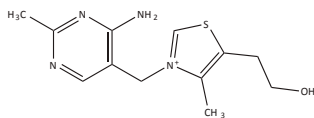
**SiliaChrom HILIC** (*hydrophilic interaction chromatography*) HPLC columns are designed to retain highly polar analytes. SiliaChrom HILIC has a selectivity that is complementary to reversed-phase columns. In fact, it has a higher retention for hydrophilic compounds in HILIC mode. HILIC sorbent is more stable and offers higher reproducibility than normal phase silica or amino columns. This phase is ideal for MedChem laboratories and is approved for SFC applications.

### Structure

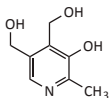


### SiliaChrom HILIC

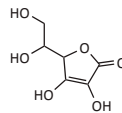
## SiliaChrom HILIC: Separation of Vitamin B Complex and Vitamin C



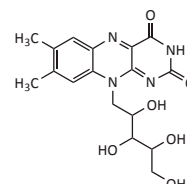
A. Thiamine (B1)



B. Pyridoxine (B6)



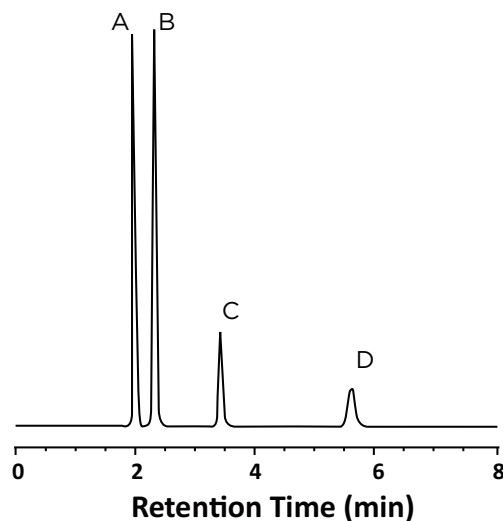
C. Ascorbic Acid (C)



D. Riboflavin (B2)

### Chromatographic conditions

- **Column:** SiliaChrom HILIC, 5  $\mu\text{m}$
- **Column size:** 4.6 x 200 mm  
SiliCycle P/N: H131805H-N150
- **Mobile phase:** 0.1% TFA in water/0.1% in ACN (90/10)
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 280 nm



### Sorbent Characteristics

#### SiliaChrom HILIC

- **Pore Size:** 100 Å
- **Specific Surface Area:** 410 - 440  $\text{m}^2/\text{g}$
- **Particle Sizes Available:** 3, 5 and 10  $\mu\text{m}$
- **Typical Carbon Loading:** 8%
- **pH Stability:** 2.0 - 8.0

#### SiliaChrom HILIC Main Characteristics

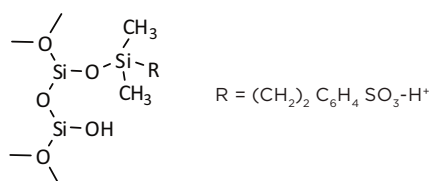
- **Unique chemistry (urea)**
- **Accepts normal and reversed phase applications**
- **Best replacement for amino HPLC column**
- **Provides high efficiency and rapid equilibration**
- **Enhanced sensitivity in mass spectrometry**
- **Non endcapped**

## SiliaChrom SCX-SAX

### Description

**SiliaChrom SCX** provides excellent resolution and peak shape for cationic analytes. SiliaChrom SCX contains a benzene sulfonic acid ligand that enables ion-exchange reversed phase and also  $\pi$ - $\pi$  (*aromatic*) interactions. SiliaChrom SCX is used for specific applications including organic bases such as basic amino acids, anilines, drug salts, inorganic cations and nucleosides analysis.

### Structure



SiliaChrom SCX

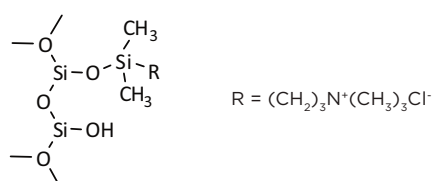
### Sorbent Characteristics

- Pore Size: 100 Å
- Specific Surface Area: 380 m<sup>2</sup>/g
- Particle Sizes Available: 3, 5 and 10 μm
- Typical Carbon Loading: SiliaChrom SCX 10%  
SiliaChrom SAX 6%
- pH Stability: 2.0 - 8.5

### Description

**SiliaChrom SAX** provides excellent resolution and peak shape for anionic analytes. SiliaChrom SAX is used for specific applications including pesticides, herbicides, pharmaceuticals, inorganic anions and biological species such as nucleotides and glucosinolates analysis.

### Structure



SiliaChrom SAX

### SiliaChrom SCX and SAX Main Characteristics

- Narrow peak shape
- Rapid equilibration
- Compatible with organic modifiers
- Provides high efficiency and rapid separations
- Endcapped

## SiliaChrom Chiral Phases

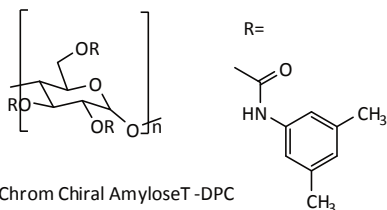
**SiliaChrom chiral** coated polysaccharide stationary phases are made with a spherical high quality silica support physically coated with a polymeric chiral selector such as amylose or cellulose derivatives. Due to the coated nature of these supports, solvents should be carefully selected for normal phase conditions.

### Description

#### SiliaChrom Chiral Amylose T-DPC:

Amylose tris-(3,5-dimethylphenylcarbamate) coated on a spherical silica support (*USP Code L51*). SiliaChrom Chiral Amylose T-DPC is used for chiral separation of alkaloids, tropines, amines and beta blockers.

### Structure



SiliaChrom Chiral Amylose T-DPC

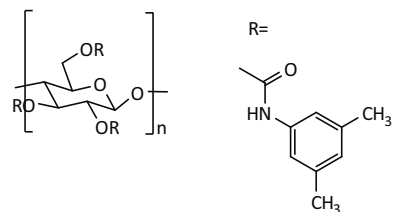
#### SiliaChrom Chiral Amylose T-DPC

### Description

#### SiliaChrom Chiral Cellulose T-DPC:

Cellulose tris-(3,5-dimethylphenylcarbamate) coated on a spherical silica support (*USP L40*). SiliaChrom Chiral Cellulose T-DPC is the most popular phase for chiral separation of alkaloids, tropines, amines and beta blockers.

### Structure



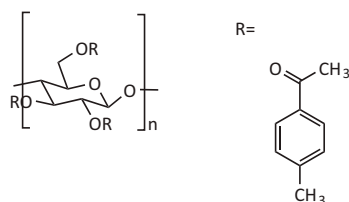
SiliaChrom Chiral Cellulose T-DPC

### Description

#### SiliaChrom Chiral Cellulose T-MB:

Cellulose tris-(4-methylbenzoate) coated on a spherical silica support. SiliaChrom Chiral Cellulose T-MB is used for chiral separation of aryl methyl esters and aryl methoxy esters.

### Structure

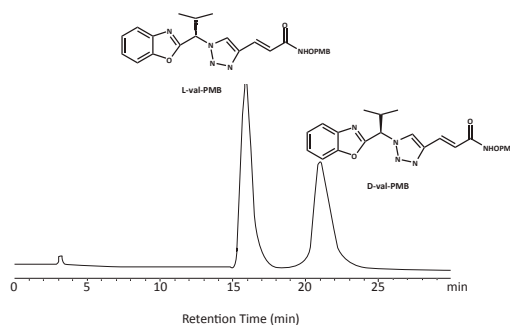


SiliaChrom Chiral Cellulose T-MB

## SiliaChrom Chiral Amylose T-DPC Enantiomeric separation of L and D-val PMB

### Chromatographic conditions

- **Column:** SiliaChrom Chiral Amylose T-DPC, 5  $\mu$ m
- **Column size:** 4.6 x 250 mm  
SiliCycle P/N: H81005T-N250
- **Mobile phase:** Hexane/Isopropanol (80/20)
- **Flow rate:** 1.000 mL/min
- **Detector:** UV at 254 nm







## Other SiliaChrom Products

Apart from the classic stationary phases, SiliCycle has also developed specific HPLC columns based on a silica matrix as our mixed-mode or phase-exclusion GF HPLC columns. To satisfy all HPLC needs, SiliCycle has polymer stationary phases in reversed phase applications (*RPC columns*) and ionic exchange HPLC applications (*IEC columns*).

### Mixed-Mode SiliaChrom

Conjugate two surface function chemistries to optimize your separation in a single experiment. SiliCycle offers the following SiliaChrom Mixed-Mode HPLC columns:

- SiliaChrom C18/C8
- SiliaChrom C18/Amide
- SiliaChrom C18/Phenyl
- SiliaChrom C18/CN
- SiliaChrom C18/SCX
- SiliaChrom C18/SAX
- SiliaChrom C18/Nitrophenyl

### Polymer-based SiliaChrom IEC

SiliaChrom IEC series are composed of polystyrene polymer-based packing bearing different functionalities such as weak or strong cationic and anionic functions. SiliaChrom IEC phases are compatible with most mobile phases and samples with a pH range from 1 to 14. Polymer-based columns tend to have lower efficiencies for small molecules compared to silica-based columns due to their smaller surface area. Nevertheless, SiliaChrom IEC packing is a good alternative for samples that require a mobile phase pH outside the normal operating range of standard silica-based columns. SiliaChrom IEC columns are generally used for ion-exchange separations, and are also useful for non-aqueous gel permeation chromatography size exclusion analyses and ion exclusion analyses of organic acids and carbohydrates.

*This family is composed of 4 stationary phases;*

- SiliaChrom IEC WA: Weak anion exchanger
- SiliaChrom IEC SA: Strong anion exchanger
- SiliaChrom IEC WC: Weak cation exchanger
- SiliaChrom IEC SC: Strong cation exchanger

### Polymer-based SiliaChrom RPC:

SiliaChrom RPC phase is a hydrophobic copolymer based on polystyrene and divinylbenzene. The macroporous RPC reversed phase resins are available in different particle sizes within a very narrow size distribution. The chemically inert polymer matrix of the SiliaChrom RPC guarantees chemical stability and allows for use with applications in the range of pH 1 to 14. The  $K'$  values measured for aromatic and conjugated molecules on RPC columns are high due to the very pure uniform hydrophobic surface. The high efficiency and high selectivity of SiliaChrom RPC columns allow the separation of analytes in minutes. Even basic substances are separated efficiently without any peak tailing.

### Silica-based SiliaChrom GF:

Size exclusion chromatography (*SEC*) also known as gel permeation chromatography (*GPC*) or gel filtration chromatography, separates molecules according to their size (*or, more accurately, according to their hydrodynamic diameter or hydrodynamic volume*). Smaller molecules are able to enter the pores of the media and, are therefore trapped and removed from the flow of the mobile phase. The average residence time in the pores depends upon the effective size of the analyte and the pore size itself. Larger molecules are excluded with essentially no retention. SiliaChrom GF column series are an appropriate set of phases to be used for size exclusion chromatography with silica-based material in normal phase conditions.

## Terms and Conditions

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### General

Unless otherwise stated, all transactions are expressly subject to these Terms and Conditions. Modifications or additions will be recognized only if accepted in writing by an officer of SiliCycle Inc. (*hereinafter named SiliCycle*), or an officially designated representative. Provisions of Buyer's Purchase Order or other documents that add to or differ from these Terms and Conditions are expressly rejected. No waiver of these Terms and Conditions or acceptance of others shall be construed as failure of the Company to raise objections.

### Privacy Policy

Because your clientele is our most vital asset, we take privacy very seriously and won't share your personal information with anyone. Your information is used only to personalize your profile and to facilitate the transaction. You can change or update your information at any time.

### Quotation and Published Prices

Quotations automatically expire 30 calendar days from the date issued unless otherwise stated. Quotes are subject to withdrawal with notice within that period. Prices shown on the published price lists and other published literature issued by SiliCycle are not unconditional offers to sell, and are subject to change without notice.

### Warranty

SiliCycle guarantees to the original Buyer that the products sold conform to the composition and purity described therein at the time of their shipment. The Buyer's sole remedy in the event that SiliCycle fails to meet said warranty shall be the replacement of the unused portion of the product(s), or if approved by SiliCycle, a refund (*at the purchase price*) provided that the Buyer returns the alleged non-conforming product(s) within 30 days after reception of product(s). SiliCycle makes no other guarantee of suitability for a particular purpose or of the merchantability in the use or handling of the product, and does not accept any liability for consequential, special, indirect or incidental damages resulting therefrom.

### Changes

The Buyer may, with the express written consent of SiliCycle, make changes in the specifications for products or work covered by the contract. In such an event, the contract price and delivery dates shall be equitably adjusted. SiliCycle shall be entitled to payment for reasonable profit plus costs and expenses incurred by work and materials rendered unnecessary as a result of such changes and for work and materials required to effect said changes.

If the Buyer has made a mistake on his/her purchase order, and the material has already been shipped and received, SiliCycle may approve the exchange of said material (*if price is identical*); however the Buyer will be responsible for all shipping costs. See return authorization policy section on the next page to obtain a return merchandise authorization form prior to returning goods.

### Cancellation

Undelivered parts of any order may be cancelled by the Buyer only with the written approval of SiliCycle. If the Buyer makes an assignment for the benefit of creditors, or in the event that SiliCycle, for any reason feels insecure about Buyer's willingness or ability to perform, SiliCycle shall have the unconditional right to cancel the sales transaction or demand full or partial payment.

In the event of any cancellation of this order by either party, the Buyer shall pay SiliCycle for reasonable costs and expenses incurred by the SiliCycle prior to receipt of the cancellation notice, plus SiliCycle's usual rate of profit for similar work.

### Taxes

The Company's prices do not include any applicable sales, goods and services, use, excise or similar taxes and the amount of any such tax SiliCycle may be required to pay or collect will be added to each invoice and paid by the Buyer.

### Terms of Payment

All merchandise purchased remains the property of SiliCycle until such time as all invoices for the merchandise have been paid in full. Except for purchases paid online, or unless explicitly stated elsewhere in writing, terms are cash net 30 days from date of invoice. Additional fees of 2% per month (26.8% per year) will accrue on all accounts past due. If any payment is in default, and it becomes necessary to hire a recovery agency or lawyer, the client accepts to pay, in addition to the outstanding balance, recovery fees equal to 20% of the balance in capital and interests. By reason of the financial condition of Buyer or otherwise, SiliCycle may require full or partial payment in advance.

Certain orders may require a deposit or progressive payments as referenced in the quote. Such deposits may be increased upon receipt of purchase order based upon the Buyer's most current credit rating. Subject to the warranties stated in this policy, all sales are final without right of return.



### Return Policy

Our Customer Service Department is available to assist you at any time should a problem arise with your order. Please make sure to inspect your packages immediately upon receipt and notify us within the next two (2) business days of any damage and/or discrepancies. Should a product be sent to you incorrectly, as the result of an error on our part, we will take quick and appropriate action to correct the problem at no charge to you.

In order to maintain the quality of our products and continue to provide competitive prices, some products may not be returned for credit. SiliCycle will not grant credit for:

- (i) Shelf-worn, used or defaced products;
- (ii) Scavengers, reagents, catalysts, or any other bounded silica whose containers have been opened;
- (iii) Products that are personalized or customized;
- (iv) Refrigerated or temperature-controlled products;
- (v) Products that have been discontinued;
- (vi) Products not directly purchased from SiliCycle

Products sold in distribution by SiliCycle will be subject to the Terms and Conditions Policy of the respective manufacturer.

Prior to any return, an authorization and a return material authorization (RMA) number must be obtained from our Customer Service Department. Shipping instructions will also be provided at this point. The RMA will ensure the safe and proper handling of material; it should therefore be referenced on all shipping labels.

The Buyer has 30 days from the issuance of the RMA to return the goods. Returns made without an authorization number will not be accepted and will be returned to the Buyer.

Returns are subject to a 50% restocking and/or disposal fee.

### Shipping Policy

SiliCycle uses a two-day or five-day delivery (or equivalent) depending on weight and availability of product. Standard overnight delivery can also be arranged. Freight charges are prepaid and added to the invoice unless special instructions are requested by the customer. These conditions apply to all North American shipments. International delivery delays will vary according to orders and destination countries.

### Delivery

Delivery dates indicated in the contract documents are approximate and based on prompt receipt of all necessary information regarding the product covered by the contract. SiliCycle will use reasonable efforts to meet the indicated delivery dates, but cannot be held responsible for its failure to do so.

In the event of any delivery delay caused by the Buyer, SiliCycle will store and handle all items ordered at Buyer's risk and will invoice Buyer for the unpaid portion of the contract price, plus storage, insurance, and handling charges on or after the date on which the product is ready for delivery. The invoice will be payable in full within 30 days from the invoice date, unless otherwise expressly agreed to in writing by SiliCycle.

SiliCycle will not hold orders unless specifically approved. SiliCycle has the right to make partial shipments and bill for those shipments; the buyer will make payment in accordance with the terms mentioned in this policy.

### Shipping and Handling Charges

Shipping charges plus the applicable company handling charges will be prepaid and billed as a separate item on the product invoice. Title to the product and risk of loss shall pass to Buyer upon delivery to a carrier.

### Application

All products are sold for laboratory or manufacturing uses. Only professional laboratory staff should handle the chemicals.

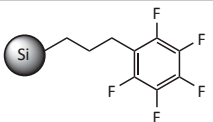
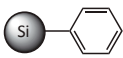
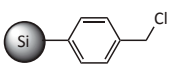
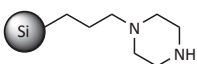
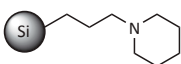

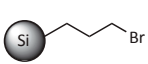
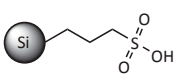
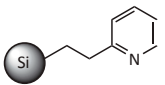
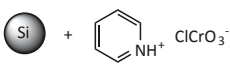
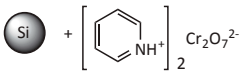

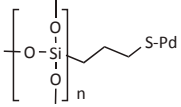
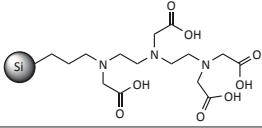
# SiliaBond & SiliaCat Listing

Category Listing			
Product (Number)	Structure	Function	Characteristics
<b>SiliaBond Allyl</b> ( <i>Si</i> -Allyl) R53530B		Solid Linker	Loading: 1.2 mmol/g Endcapping: yes Density: 0.613 g/mL
<b>SiliaBond Aluminium Chloride</b> ( <i>Si</i> -AlCl <sub>x</sub> ) R74530B		Catalyst & Reagent	Loading: 1.6 mmol/g Endcapping: no
<b>SiliaBond Amine</b> ( <i>Si</i> -WAX or <i>Si</i> -NH <sub>2</sub> ) R52030B		Base, Metal Scavenger Chromatographic Phase Ion Exchange Phase	Loading: 1.6 mmol/g Endcapping: yes Density: 0.700 g/mL
<b>SiliaBond Bromophenyl</b> ( <i>Si</i> -BRP) R55030B		Linker	Loading: 1.6 mmol/g Endcapping: yes Density: 0.742 g/mL
<b>SiliaBond C18</b> R30030B, R30130B, R33230B, R33330B...		Chromatographic Phase	Loading: 11 to 23 %C Endcapping: yes & no
<b>SiliaBond C12</b> R53030B		Chromatographic Phase	Loading: 16 %C Endcapping: yes Density: 0.665 g/mL
<b>SiliaBond C8</b> R31030B & R31130B		Chromatographic Phase	Loading: 12 %C Endcapping: yes & no Density: 0.759 g/mL
<b>SiliaBond C4</b> R32030B & R32130B		Chromatographic Phase	Loading: 8 %C Endcapping: yes & no Density: 0.656 g/mL
<b>SiliaBond C1</b> R33030B		Chromatographic Phase	Loading: 5 %C Endcapping: yes Density: 0.599 g/mL
<b>SiliaBond Carbodiimide</b> ( <i>Si</i> -DCC) R70530B		Reagent	Loading: 0.9 mmol/g Endcapping: yes Density: 0.751 g/mL
<b>SiliaBond Carbonate</b> ( <i>Si</i> -CO <sub>3</sub> ) R66030B		Base Organic Scavenger	Loading: 0.7 mmol/g Endcapping: no Density: 0.608 g/mL
<b>SiliaMetS Diamine</b> ( <i>Si</i> -DIA) R49030B		Metal Scavenger Base Ion Exchange Phase	Loading: 1.4 mmol/g Endcapping: yes Density: 0.728 g/mL
<b>SiliaBond Dichlorotriazine</b> ( <i>Si</i> -DCT) R52230B		Reagent	Loading: 0.7 mmol/g Endcapping: yes Density: 0.781 g/mL
<b>SiliaBond Diethylamine</b> ( <i>Si</i> -WAX-2) R76530B		Base Ion Exchange Phase	Loading: 1.2 mmol/g Endcapping: yes Density: 0.685 g/mL
<b>SiliaBond Dimethylamine</b> R45030B		Base	Loading: 1.4 mmol/g Endcapping: yes Density: 0.762 g/mL
<b>SiliaBond Diol</b> R35030B		Chromatographic Phase Organic Scavenger	Loading: 1.0 mmol/g Endcapping: no Density: 0.688 g/mL



Category Listing			
Product (Number)	Structure	Function	Characteristics
<b>SiliaBond Diphenylphosphine</b> ( <i>Si</i> -DPP) R39030B		Reagent	Loading: 0.9 mmol/g Endcapping: yes Density: 0.692 g/mL
<b>SiliaBond DMAP</b> ( <i>Si</i> -DMAP) R75530B		Catalyst & Reagent	Loading: 0.8 mmol/g Endcapping: yes Density: 0.674 g/mL
<b>SiliaMetS DMT</b> R79030B		Metal Scavenger	Loading: 0.5 mmol/g Endcapping: yes Density: 0.732 g/mL
<b>SiliaCat DPP-Pd</b> R390-100		Catalyst	Loading: > 0.2 mmol/g Endcapping: yes Density: 0.415 g/mL
<b>SiliaBond EDC</b> R70630B		Reagent	Loading: 0.8 mmol/g Endcapping: yes Density: 0.770 g/mL
<b>SiliaBond Fluorochrom</b> ( <i>Si</i> -FCM) R63730B		Fluorous Phase	Loading: 7 % Carbon Endcapping: yes Density: 0.738 g/mL
<b>SiliaBond Glycidoxy</b> ( <i>Si</i> -GLY) R36030B		Linker	Loading: 1.1 mmol/g Endcapping: no Density: 0.662 g/mL
<b>SiliaMetS Imidazole</b> ( <i>Si</i> -IMI) R79230B		Base Metal Scavenger	Loading: 0.9 mmol/g Endcapping: no Density: 0.681 g/mL
<b>SiliaBond HOBt</b> R70730B		Reagent	Loading: 0.8 mmol/g Endcapping: yes Density: TBD
<b>SiliaBond Isocyanate</b> ( <i>Si</i> -ISO) R50030B		Nucleophile Scavenger	Loading: 1.2 mmol/g Endcapping: yes Density: 0.741 g/mL
<b>SiliaBond Maleimide</b> ( <i>Si</i> -MAL) R71030B		Organic Scavenger	Loading: 0.7 mmol/g Endcapping: yes
<b>SiliaBond Morpholine</b> ( <i>Si</i> -MOR) R68030B		Base	Loading: 1.1 mmol/g Endcapping: yes Density: 0.666 g/mL
<b>SiliaCat Pd<sup>0</sup></b> R815-100		Catalyst	N/A
<b>SiliaCat Pt<sup>0</sup></b> R820-100		Catalyst	N/A

# SiliaBond & SiliaCat Listing (con't)

Category Listing			
Product (Number)	Structure	Function	Characteristics
<b>SiliaBond</b> Pentafluorophenyl ( <i>Si</i> -PFP) R67530B		Fluorous Phase	Loading: 0.8 mmol/g Endcapping: yes Density: 0.666 g/mL
<b>SiliaBond</b> Phenyl ( <i>Si</i> -PHE) R34030B		Chromatographic Phase	Loading: 1.2 mmol/g Endcapping: yes Density: 0.637 g/mL
<b>SiliaBond</b> Phenylmethylchloride R56530B		Linker	Loading: 0.5 mmol/g Endcapping: yes Density: 0.637 g/mL
<b>SiliaBond</b> Piperazine ( <i>Si</i> -PPZ) R60030B		Base	Loading: 0.8 mmol/g Endcapping: yes Density: 0.671 g/mL
<b>SiliaBond</b> Piperidine ( <i>Si</i> -PIP) R71530B		Base	Loading: 1.1 mmol/g Endcapping: yes Density: 0.660 g/mL
<b>SiliaBond</b> Potassium Permanganate R23030B		Oxidant	Loading: 10 % w/w Endcapping: no Density: 0.593 g/mL
<b>SiliaBond</b> Propyl Bromide ( <i>Si</i> -PBR) R55530B		Linker	Loading: 1.5 mmol/g Endcapping: yes Density: 0.748 g/mL
<b>SiliaBond</b> Propylsulfonic Acid ( <i>Si</i> -SCX-2) R51230B		Acid, Reagent Ion Exchange Phase Nucleophile Scavenger	Loading: 1.0 mmol/g Endcapping: yes Density: 0.728 g/mL
<b>SiliaBond</b> Pyridine ( <i>Si</i> -PYR) R43030B		Base	Loading: 1.3 mmol/g Endcapping: yes Density: 0.727 g/mL
<b>SiliaBond</b> Pyridinium Chlorochromate (PCC) R24030B		Oxidant	Loading: 20 % w/w Endcapping: no Density: 0.693 g/mL
<b>SiliaBond</b> Pyridinium Dichromate (PDC) R24530B		Oxidant	Loading: 20 % w/w Endcapping: no Density: 0.651 g/mL
<b>SiliaBond</b> Silver Nitrate ( <i>Si</i> -AgNO <sub>3</sub> ) R23530B		Chromatographic Phase	Loading: 10 % w/w Endcapping: no Density: 0.651 g/mL
<b>SiliaCat</b> S-Pd R510-100		Catalyst	Loading: >0.3 mmol/g Endcapping: yes Density: 0.550 g/mL
<b>SiliaMetS</b> TAAcOH R69030B		Acid Metal Scavenger	Loading: 0.4 mmol/g Endcapping: yes Density: 0.632 g/mL
<b>SiliaMetS</b> TAAcONa R69230B	Same as TAAcOH but with Na	Metal Scavenger	Loading: 0.4 mmol/g Endcapping: yes Density: 0.712 g/mL





Category Listing			
Product (Number)	Structure	Function	Characteristics
<b>SiliaBond TBA Chloride</b> ( <i>Si</i> -TBACl) R65530B		Ion Exchanger Phase	Loading: 0.5 mmol/g Endcapping: no Density: 0.751 g/mL
<b>SiliaBond TBD</b> R68530B		Base Metal Scavenger Reagent	Loading: 0.9 mmol/g Endcapping: yes Density: 0.730 g/mL
<b>SiliaCat TEMPO</b> R723-100		Catalyst	Loading: 0.7 mmol/g Endcapping: yes Density: 0.639 g/mL
<b>SiliaMetS Thiol</b> R51030B		Metal Scavenger	Loading: 1.2 mmol/g Endcapping: yes Density: 0.682 g/mL
<b>SiliaMetS Thiourea</b> ( <i>Si</i> -THU) R69530B		Metal Scavenger	Loading: 1.2 mmol/g Endcapping: yes Density: 0.767 g/mL
<b>SiliaBond TMA Acetate</b> ( <i>Si</i> -SAX-2) R66430B		Ion Exchange Phase	Loading: 1.0 mmol/g Endcapping: no Density: 0.665 g/mL
<b>SiliaBond TMA Chloride</b> ( <i>Si</i> -SAX) R66530B		Ion Exchange Phase	Loading: 1.1 mmol/g Endcapping: no Density: 0.751 g/mL
<b>SiliaBond Tonic Acid</b> ( <i>Si</i> -SCX) R60530B		Acid, Reagent Nucleophile Scavenger Ion Exchange Phase	Loading: 0.8 mmol/g Endcapping: yes Density: 0.743 g/mL
<b>SiliaBond Tosyl Chloride</b> ( <i>Si</i> -TsCl) R44030B		Nucleophile Scavenger	Loading: 1.0 mmol/g Endcapping: yes Density: 0.761 g/mL
<b>SiliaBond Tosyl Hydrazine</b> ( <i>Si</i> -TsNHNH <sub>2</sub> ) R61030B		Electrophile Scavenger	Loading: 1.5 mmol/g Endcapping: yes
<b>SiliaMetS Triamine</b> ( <i>Si</i> -TRI) R48030B		Base Metal Scavenger	Loading: 1.2 mmol/g Endcapping: yes Density: 0.736 g/mL
<b>SiliaBond Tridecafluoro</b> ( <i>Si</i> -TDF) R63530B		Fluorous Phase	Loading: 0.5 mmol/g Endcapping: yes Density: 0.842 g/mL
<b>SiliaBond Urea</b> R67030B		Scavenger Chromatographic Phase	Loading: 1.3 mmol/g Endcapping: yes Density: 0.695 g/mL