SILICYCLE

BRUNSCHWIG

SOLUTIONS FOR PEPTIDE SYNTHESIS

www.chemie-brunschwig.ch

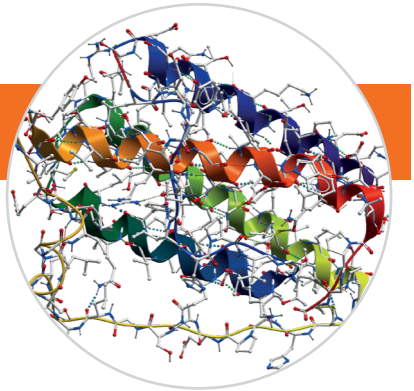
Auf dem Wolf 10 - 4052 Basel - Switzerland

info@brunschwig-ch.com

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.

Solutions for Peptide Synthesis

SiliCycle Solutions for Peptide Synthesis



- **Solutions for peptide synthesis**
- **Solutions for work-up after peptide synthesis**

SiliCycle offers solutions to problems encountered in the peptide research field, either for the peptide synthesis itself or for subsequent work-up.

Peptide synthesis:

- Supported Silia*Bond* reagents can be used during peptide synthesis and other amide bond-forming reactions, and excess reagents elimination will be reduced to a simple filtration.
- Some Silia*Bond* reagents can also be used for Fmoc deprotection of peptides in liquid phase.

Work-up after peptide synthesis:

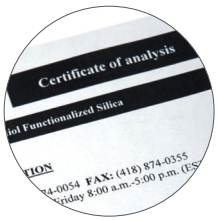
- Silia*Bond* reagents can be used for amines scavenging (*catch and release of weak cations*), amine free basing, HOBt scavenging, TFA removal, or residual azide removal after a click reaction.
- Silia*Prep* SPE cartridges packed with C18 Widepore (*WPD, 125 Å*) can be used for trap-elute of relatively polar peptides after cleavage or cysteine oxidation.
- Silia*MetS* are useful to remove residual metal after a catalytic reaction.
- Silia*Sep* flash cartridges can be used for peptide purification.
- Silia*Chrom* HPLC columns are available in analytical and preparative dimensions (*4.6 mm ID up to 50 mm ID*), and in a variety of phases, to allow large scale peptide purification. In addition, spherical silica gels Silia*Sphere* are also offered in bulk to allow DAC packing, giving even more options.

Quality and Regulatory Documentation

SiliCycle's products are more and more used in GMP pharmaceutical, biotechnology and fine chemical industries as well as contract research and manufacturing organizations. Many have run their own analysis proving that our products can safely be used without compromising the purity of their compounds.

SiliCycle is committed to high quality standards and all products are manufactured in an ISO 9001:2015 compliant facility and subjected to stringent quality control.

For any inquiries, please contact: support@silicycle.com



All products are shipped with the following information:

- Certificate of Analysis (*COA*)
- Safety Data Sheet (*SDS*)
- Technical Information

Other statements available upon request:

- BSE / TSE Declaration (*non animal-derived*)
- GMO-Free Certificate
- Melamine-Free Certificate, etc.

SiliCycle can also work with you to provide customized regulatory documents, including specific analytical tests in line with your needs.

Manufacturing Capability

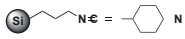
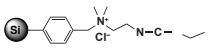
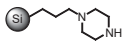
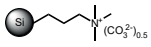
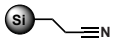
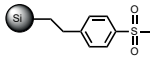
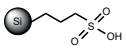
Functionalized silica gels are manufactured at our headquarters in Quebec City, where we can meet all customers production needs.

Our state of the art facilities include (*but are not limited to*):

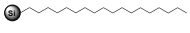
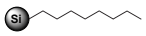
- 1,000 L to 10,000 L reactors (*total capacity of 38,000 L*)
- Stainless steel and hastelloy nutsche filters (*3 m²*)
- Bulk solvent tank farm (*60,000 L capacity*)

Enjoy a virtual tour of SiliCycle's facility

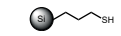
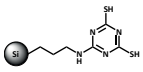
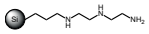
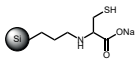
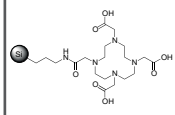
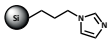
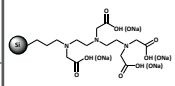
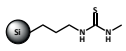
Reagents and Organic Scavengers Portfolio

Reagents and Organic Scavengers Technical Information				
Products	**Structure**	**Brief Description**	**Typical Reactions**	**Typical Characteristics** [a, b]
Silia*Bond* Carbodiimide PN: R70530B Loading: ≥ 0.91 mmol/g Endcapping: Yes		Most commonly used reagents 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: 3 Shelf Life: 2 Years
Silia*Bond* Ethyl Carbodiimide PN: R70630B Loading: ≥ 0.32 mmol/g Endcapping: Yes				Color: Orange Density: 0.770 g/mL Solvent Compatibility: 3 Prolonged Storage: 3 Shelf Life: 2 Years
Silia*Bond* Piperazine PN: R60030B Loading: ≥ 0.83 mmol/g Endcapping: Yes		Used deprotecting and scavenging agent for Fmoc and Bsmoc amino protecting groups. Silia*Bond* Piperazine may also be used to scavenge electrophiles.	Fmoc and Bsoc deprotection, organic scavenger	Color: Off-white Density: 0.671 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years
Silia*Bond* 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.	Free basing of amine	Color: Off-white Density: 0.608 g/mL Solvent Compatibility: 3 Prolonged Storage: 2 Shelf Life: 1 Year
Silia*Bond* Cyano PN: R38030B Loading: ≥ 1.38 mmol/g Endcapping: Yes		Less polar than silica, Silia*Bond* Cyano has a great affinity for polar compounds.	Residual azide removal, after a click reaction	Color: Off-white Density: 0.703 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*Bond* Tosic Acid (*SCX*) PN: R60530B Loading: ≥ 0.54 meq/g Endcapping: Yes		Silia*Bond* Tosic Acid is in a class of strong acids. The aromatic ring makes it slightly more acidic than other supported sulfonic acids.	Strong cation exchanger (*SCX*) for amine "Catch and Release" purification	Color: Off-white Density: 0.698 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*Bond* Propylsulfonic Acid (*SCX-2*) PN: R51230B Loading: ≥ 0.63 meq/g Endcapping: Yes		Supported sulfonic acid presenting a slighly more non-polar character than the SCX, thus reducing secondary interactions.	Strong cation exchanger (*SCX*) for amine "Catch and Release" purification	Color: Off-white Density: 0.728 g/mL Solvent Compatibility: 2 Prolonged Storage: 1 Shelf Life: 2 Years

Spherical Silica Gels in Bulk and HPLC Columns Portfolio

Spherical Silica Gels in Bulk and HPLC Columns Portfolio (*refer to the ordering section for product number*)		
Sorbent Phase	**Functional Group**	**Typical Applications**
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.
Cyano		Moderate non-polar sorbent with less hydrophobicity than C18 or C8. Purification of cyclosporine and carbohydrates. Les polar sorbent compared to silica, used for the purification of polar organic compounds.
Silica		Most polar sorbent with a slight acidic character. Used for purification of polar and non-ionic compounds.

Metal Scavengers Portfolio

Metal Scavengers Technical Information				
Scavengers	**Structure**	**Brief Description**	**Metals Removed** [c]	**Typical Characteristics** [a, b]
Silia*MetS* Thiol PN: R51030B Loading: ≥ 1.20 mmol/g Endcapping: Yes		Silia*MetS* 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 & U	Color: White Density: 0.682 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 4 Years
Silia*MetS* DMT PN: R79030B Loading: ≥ 0.50 mmol/g Endcapping: Yes		Silia*MetS* DMT is the silica-bound equivalent of 2,4,6-trimercaptotriazine (*trithiocyanuric acid, TMT*). It is a versatile metal scavenger for a variety of metals and the preferred metal scavenger for ruthenium catalysts and hindered Pd complexes (*i.e. Pd(dppf)Cl$_2$*).	**Au, Bi, Ir, Ni, Os, Pd, Pt, Re, Rh, Ru & U** Cd, Co, Cu, Fe, Sc & Zn	Color: Light brown Density: 0.732 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*Bond* Amine PN: R52030B Loading: ≥ 1.20 mmol/g Endcapping: Yes		Also known for their electrophile scavenging efficiencies and their base reagent qualities, Silia*MetS* 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, U, W & Zn	Color: Off-white Density: 0.700 g/mL Solvent Compatibility: 2 Prolonged Storage: 2 Shelf Life: 2 Years
Silia*MetS* Triamine PN: R48030B Loading: ≥ 1.11 mmol/g Endcapping: Yes			**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
Silia*MetS* Cysteine PN: R80530B Loading: ≥ 0.30 mmol/g Endcapping: Yes		Silia*MetS* 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 & U** Ca, Cr, Cs, Cu, La, Mg, Pd, Pt, Rh & Zn	Color: Orange Density: 0.665 g/mL Solvent Compatibility: 2 Prolonged Storage: 3 Shelf Life: 1 Year
Silia*MetS* DOTA PN: R91030B Loading: ≥ 0.38 mmol/g Endcapping: Yes		Silia*MetS* 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
Silia*MetS* Imidazole PN: R79230B Loading: ≥ 0.96 mmol/g Endcapping: Yes		Silia*MetS* 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, U, W & Zn** Cr, Pd & Rh	Color: Off-white Density: 0.681 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*MetS* TAAcOH PN: R69030B Loading: ≥ 0.41 mmol/g Endcapping: No		Silia*MetS* 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. Silia*MetS* TAAcOH is effective for metals in low or zero oxidation states, compared to Silia*MetS* TAAcONa which is useful for metals in higher oxidation states (≥ 2).	**Au, Ca, Co, Ir, Li, Mg, Ni, Os, Ru, Sc & U** Cr, Cs, Fe, Pd, Rh & Sn	Color: Off-white Density: 0.635 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*MetS* TAAcONa PN: R69230B Loading: ≥ 0.41 mmol/g Endcapping: No			**Bi, Ca, Cd, Cs, Cu, Fe, Ir, La, Li, Mg, Ni, Os, Rh, Sc, Sn & U** Cr, Pd, Ru & Zn	Color: Off-white Density: 0.712 g/mL Solvent Compatibility: 1 Prolonged Storage: 1 Shelf Life: 2 Years
Silia*MetS* Thiourea PN: R69530B Loading: ≥ 1.07 mmol/g Endcapping: Yes		Silia*MetS* 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

[a] **Solvent Compatibility:**
1- All solvents, aqueous and organic
2- All organic solvents
3- Anhydrous aprotic solvents

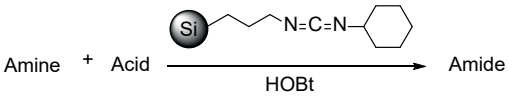
[b] **Prolonged Storage:**
1- Keep dry
2- Keep cool (≤ *8°C*) and dry
3- Keep cool (≤ *8°C*), dry, and under inert atmosphere

[c] **Scavenging Efficiency:**

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

Peptide Synthesis and Amide Bond-Forming Reactions

- 1,3-Dicyclohexylcarbodiimide (*DCC*) has arguably become one of the most commonly used reagents in peptide synthesis and other amide bond-forming reactions of primary and secondary amines with carboxylic acids. The major drawback associated with using DCC is the formation of the urea by-product (*DCU*) which remains in solution and requires additional purification steps to remove it. However, by using Silia*Bond* Carbodiimide (*DCC*) it is possible to avoid problematic purifications. Only a simple filtration step is needed to remove the unwanted DCU.
For more details on the experimental procedures, see Appn_SBR004-0.



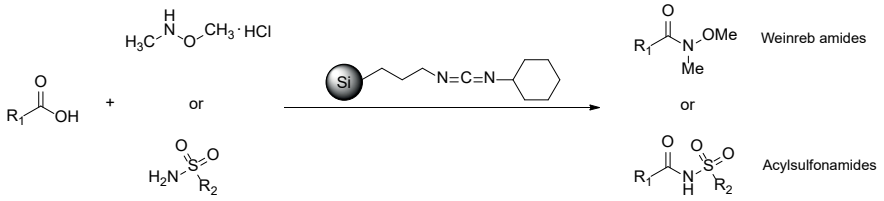
Yield (%) and Purity (%) of Amides Synthesized Using Silia*Bond* Carbodiimide (*DCC*)

Rn #	Acid	Amine	Bulk Meth. #1 Yield (%) (% Purity)	Bulk Meth. #2 Yield (%) (% Purity)	SPE Yield (%) (% Purity)	Rn #	Acid	Amine	Bulk Meth. #1 Yield (%) (% Purity)	Bulk Meth. #2 Yield (%) (% Purity)	SPE Yield (%) (% Purity)
1	Benzoic acid	Aniline	75.5 (*99.1*)	70.1 (*96.4*)	81.2 (*97.2*)	6	Boc-Phe-OH (*L*)	Phenylethylamine	100.0 (*97.6*)	100.0 (*97.6*)	99.2 (*90.1*)
2		Benzylamine	100.0 (*95.4*)	80.1 (*98.1*)	100.0 (*98.7*)	7	Fmoc-Phe-OH (*D*)		N.A.	100.0 (*> 95.0*)	N.A.
3		Phenylethylamine	98.7 (*97.1*)	78.7 (*98.3*)	100.0 (*98.8*)	8	Z-Val-OH		100.0 (*> 95.0*)	93.5 (*> 95.0*)	100.0 (*> 95.0*)
4	Phenoxyacetic acid	*tert*-Butylamine	100.0 (*97.4*)	100.0 (*94.0*)	98.2[a] (*94.5*)	9	3-Iodobenzoic acid	Benzylamine	100.0 (*98.5*)	100.0 (*97.1*)	100.0 (*94.5*)
5		1,2,3,4-Tetrahydro-isoquinoline	99.8 (*95.0*)	100.0 (*92.5*)	97.2 (*92.4*)	10	Heptanoic acid	Ethanolamine	72.3 (*95.5*)	84.3 (*98.0*)	81.3[b] (*93.0*)

Notes: The final amides were analyzed by ^{1}H and ^{13}C NMR or GC-MS. Yield corresponds to the mass of isolated product. Purity was determined by GC-FID.
[a] In DMF; [b] No HOBt

- Silia*Bond* Carbodiimide (*DCC*) has also been succesfully used for the synthesis of Weinreb amides and acylsulfonamides as shown here.

For more details on the experimental procedures, see Appn_SBR004-0.



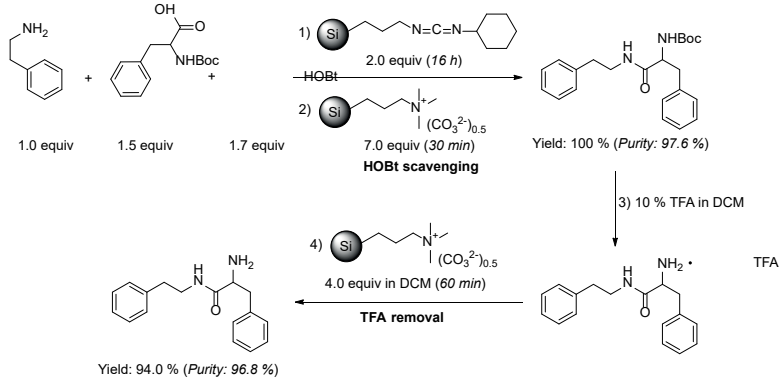
Yield (%) and Purity (%) of Weinreb Amides and Acylsulfonamides Synthesized Using Silia*Bond* Carbodiimide (*DCC*)

Rn #	Weinreb Amides Acid	Weinreb Amides Amine	Weinreb Amides Yield (%) (% Purity)*	Rn #	Acylsulfonamides Acid	Acylsulfonamides Amine	Acylsulfonamides Yield (%) (% Purity)**
1	Benzoic acid	N,O-dimethylhydroxylamine hydrochloride	98.8 (*95.5*)	1	Benzoic acid	Benzenesulfonamide	95.5 (*71.3*)
2	*t*-Cinnamic acid		87.3 (*94.7*)	2		Methanesulfonamide	78.8 (53.*1*)
3	2-Nitrobenzoic acid		99.5 (*93.2*)				

* Determined by GC-FID. ** Purity was determined by GC-FID (*the purity obtained is lower than in the previous synthesis because scavenging step using Silia*Bond* Amine, to eliminate the acid in excess, hasn't been done*).

- In this particular example, the Silia*Bond* Carbodiimide was used as the coupling reagent, followed by Silia*Bond* Carbonate to remove HOBt (*the catalyst*). As TFA salt of the amide was formed by the removal of the Boc protecting group, Silia*Bond* Carbonate was used a second time to remove it. Yields in the above figure refer to the mass of isolated product and purity is determined by GC-FID.

For more details, see Appn_SB012-0.



Amine Free Basing

Supported sulfonic acids are in a class of strong acids (*pKa < 1*) widely used in different fields of synthetic organic chemistry. Their applications are very well-known in a large number of settings, from drug discovery laboratories up to manufacturing processes. Among these applications are: acid catalysts, stationary phases for ion chromatography, basic impurity scavengers, and they are very useful for more specific organic synthesis applications, like amine free basing and Boc group deprotection. Their most common use is probably as a strong cation exchanger (*SCX*) for the "Catch and Release" purification of amines in SPE cartridges.
For more details, see Appn_SP004-0.

Procedure - Tosic Acid (*SCX*) and Propylsulfonic Acid (*SCX-2*) in SPE cartridges

Catch and Release of Amines with SCX and SCX-2	
Cartridges used	SiliaPrep Tosic Acid (*SCX*) 6 mL / 500 mg (*SPE-R60530B-06P*) SiliaPrep Propylsulfonic Acid (*SCX-2*) 6 mL / 500 mg (*SPE-R51230B-06P*)
Samples	Amine (*1 equiv*) dissolved in methanol (*2,500 ppm*)
Conditioning step	6 mL of methanol
Loading step	Samples slowly aspirated through the cartridges
Washing step	6 mL of methanol (*1 mL/min*)
Elution step	6 mL of 2 M ammonia / methanol

Results

Catch and Release of Amines with SCX and SCX-2											
Amine	pKa	Catch (%)		Release (%)		Amine	pKa	Catch (%)		Release (%)	
		SCX	SCX-2	SCX	SCX-2			SCX	SCX-2	SCX	SCX-2
4-nitroaniline	0.98	98	97	100	100	Benzylmethylamine	9.58	100	100	100	97
Aniline	4.62	100	100	95	96	Cyclohexylamine	10.64	100	96	95	96
4-methoxyaniline	5.29	100	100	100	100	Tributylamine	10.75	100	100	100	98
Morpholine	8.36	100	100	100	89	Quinuclidine	11.00	100	100	94	98

Although the aromatic ring of the Tosic Acid makes it slightly more acidic than Propylsulfonic Acid, these studies demonstrate that they have comparable strength. In fact, the difference between the two products is mainly in the selectivity.

HOBt Scavenging

The use of functionalized silica greatly simplifies not only organic synthesis but also purification. In some cases, the work-up is reduced to a simple filtration and evaporation of the solvent. As demonstrated by the examples below, SiliaBond Carbonate could play a key role in further simplifying the work-up in amide coupling reactions. For more details, see Appn_SB012-0.

Procedure - SiliaBond Carbonate in bulk

HOBt Scavenging - Bulk	
1	Add 2 - 4 equivalents of SiliaBond Carbonate to the HOBt solution (*in DMF*)
2	Stir for 1 hour at room temperature
3	Remove the SiliaBond carbonate by filtration and rinse with DMF
4	Solvent evaporation gives the HOBt free solution

Procedure - SiliaBond Carbonate in SPE cartridges

HOBt Scavenging - SPE Cartridges	
Conditioning step	1 x CV of DMF
Loading step	Load the HOBt solution
Rinsing step	1 x CV of DMF

Note: CV = Column Volume

Results

Scavenging with SiliaBond and SiliaPrep Carbonate									
Number of Equivalents	Product	Reaction Time (*min*)	Final HOBt Conc.* (*ppm*)	Scavenging Yield (%)	Number of Equivalents	Product	Reaction Time (*min*)	Final HOBt Conc.* (*ppm*)	Scavenging Yield (%)
3	SiliaBond	5	32	99.4	4	SiliaBond	5	22	99.6
		60	32	99.4			60	21	99.6
	SiliaPrep	-	< 5	> 99.9		SiliaPrep	-	< 5	> 99.9

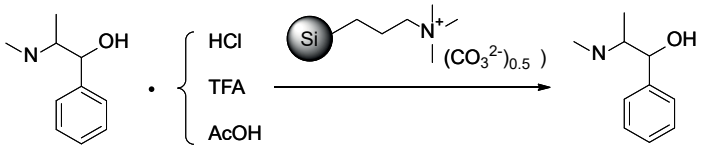
* Determined by GC-MS. Initial HOBt concentration: 5,000 ppm in DMF.

TFA Removal

Trifluoroacetic acid (*TFA*) is certainly the most commonly used ion-pairing agent for the separation of peptides in reversed-phase ion-pairing chromatography. This is due to TFA being a volatile solvent and therefore easier to remove, having low absorption within detection wavelengths, and its effectiveness is well established.

The role of TFA is to act as a buffer (*keeping the charge on the analyte and avoiding precipitation*), to impart some hydrophobicity to the amino groups, and to neutralize cationic charges.

Usually after HPLC separation and evaporation of the solvent, the peptide is isolated in its TFA salt form and it is well-known that peptides stored this way exhibit reduced stability. Hence it is necessary to use a method to freebase the peptides prior to their storage. The use of Silia*Bond* Carbonate was investigated in the following study as an efficient and convenient solution to this problem. For more details, see Appn_SB012-0.



SPE Cartridges Packed With Silia*Bond* Carbonate

Non-retentive SPE (*Catch and Release*) allows peptides to be eluted directly during the loading and rinsing steps (*i.e., won't be retained on the sorbent*) while the TFA remains in the SPE cartridge.

Procedure

Catch and Release of the Analyte	
Conditioning step	1 x CV of THF
Loading step	Load the amine solution (*in THF*)
Rinsing step	1 x CV of THF

Note: CV = Column Volume

Results

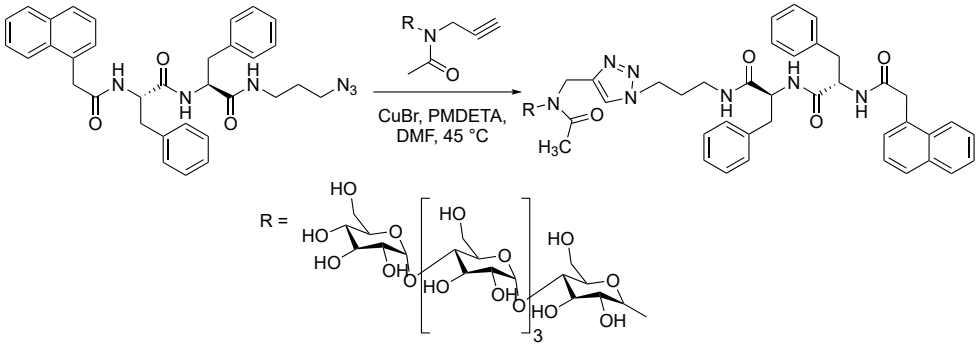
Salt Removal Using Silia*Prep* Carbonate SPE Cartridges			
Amine Salts		Yield[A] (%)	Purity[B] (%)
Ephedrine	HCl	98.7	94.4
	TFA	100	98.9
	AcOH	100	99.2

[A] Yields refer to the mass of isolated product.

[B] Purities determined by GC-FID.

Residual Metal Removal After a Catalytic Reaction

Nishimura's team at Shinshu University synthesized supramolecular hydrogels (*i.e. cross-linked fiber networks that swell*) encapsulated with enzymes. The biocatalytic supramolecular shear-thinning hydrogels are fabricated by self-assembly of amphiphilic carbohydrate-conjugated diphenylalanine derivatives. The amphiphilic glycopeptides are synthesized by a copper-catalyzed Huisgen reaction. Residual copper was scavenged using Silia*MetS* Triamine (*r.t. in DMF, number of equivalent, reaction time, concentration of Cu before and after scavenging as well as scavenging yield are unknown*). For more details, see CS_SM014-0.



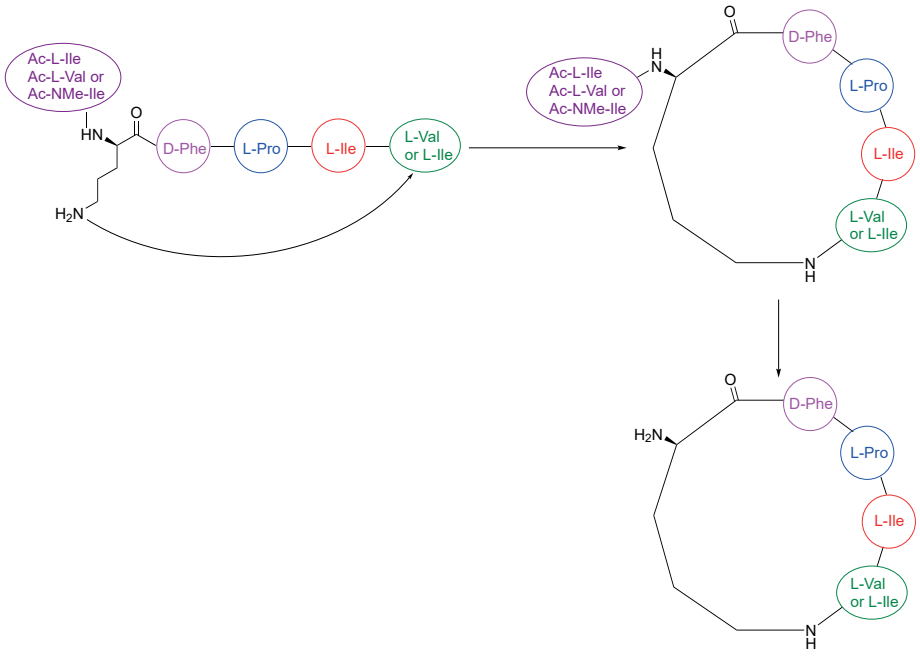
Sakamoto, Y. et al. *Langmuir* **2022**, *38*, 5883-5890.

Peptide Purification by Flash Chromatography

Voyer's team reported the first total synthesis of the cycle-tail peptides known as pseudacyclins A-E with high overall yields. The strategy was based on the use of orthogonally protected ornithine that yielded protected-cyclic peptides that were later hydrogenolyzed to give the exocyclic amines. The hydrogenolysis step of these types of syntheses is usually purified by HPLC, and the purification is long, tedious, and gives poor yields.

Voyer's team developed a powerful normal-phase method for rapid separation of the monomers from the dimers using Silia*Sep* PREMIUM Spherical Flash Cartridges obtaining yields from 52 to 56 % with a purity of 98 to 99 %. The chromatographic conditions are reported on the right. For more details, see CS_SS002-0.

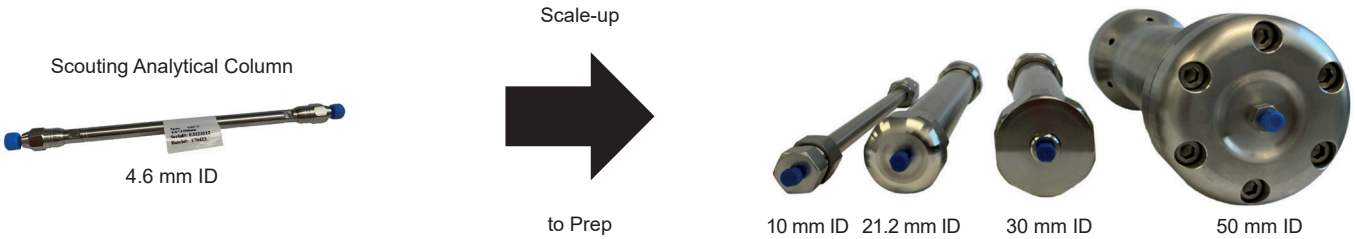
Chromatographic Conditions	
Parameter	**Value**
Cartridge	Silia*Sep* PREMIUM Flash Cartridge, Silica-Based, 25 µm, 90 Å
Part Number	FLH-10095D-A-ISO40
Gradient	Linear gradient 100 % dichloromethane to 80:20 dichloromethane:methanol (*19 CV*)
Flow Rate	25 mL/min



Bérubé, C. et al. *Tetrahedron Letters* **2018**, *59*, 4176-4179.

Peptide Purification by Preparative HPLC and DAC

In large scale purification using high pressure chromatography, it is paramount to first screen & scout analytical columns and then be able to scale-up using prep columns of the same silica (*phase and particle size*). That's why our HPLC columns are available in analytical dimensions (*4.6 mm ID*) and preparative dimensions (*10, 21.2, 30, and 50 mm ID*). In addition, bulk silica is also offered to allow DAC packing, giving the purification scientist even more options.



+ Bulk for DAC packing
(*available in -50G, -250G, -500G, and -1KG formats*)

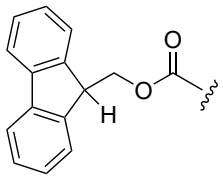
Other Applications

Trap-Elute of Polar Peptides

Silia*Prep* SPE cartridges packed with C18 Widepore (*WPD, 125 Å*) can be used for trap-elute of relatively polar peptides after cleavage or cysteine oxidation.

Fmoc Deprotection of Peptides

Silia*Bond* Piperazine (*Si-PPZ*) is a useful deprotecting and scavenging agent for Fmoc and Bsmoc amino protecting groups, and can also be used as a solid-phase Knoevenagel catalyst.



Removal of Residual Azide

Silia*Bond* Cyano can be useful to remove residual azide (*starting material*) after a click reaction.

Ordering Information

Bulk Irregular Silica Gels

Our silica gels are available from 5 g up to 25 kg formats. All particle size and pore size are respectively 40 - 63 µm, 60 Å for theseproducts.

To build your own product number, just add the quantity to the Phase PN: [Phase PN]-[Quantity Code]

Example: 100 g of Thiol silica gel, 40 - 63 µm, 60 Å: R51030B-100G

Reagents and Organic Scavengers	
Product Names	Phase PN
Silia*Bond* Carbodiimide	R70530B
Silia*Bond* Ethyl Carbodiimide	R70630B
Silia*Bond* Piperazine	R60030B
Silia*Bond* Carbonate	R66030B
Silia*Bond* Cyano	R38030B
Silia*Bond* Tosic Acid (*SCX*)	R60530B
Silia*Bond* Propylsulfonic Acid (*SCX-2*)	R51230B

Metal Scavengers	
Product Names	Phase PN
Silia*MetS* Thiol	R51030B
Silia*MetS* DMT	R79030B
Silia*Bond* Amine	R52030B
Silia*MetS* Triamine	R48030B
Silia*MetS* Cysteine	R80530B
Silia*MetS* DOTA	R91030B
Silia*MetS* Imidazole	R79230B
Silia*MetS* TAAcOH	R69030B
Silia*MetS* TAAcONa	R69230B
Silia*MetS* Thiourea	R69530B

Bulk Spherical Silica Gels

The table below presents the most popular Silia*Sphere* bonded phases available from SiliCycle.

To build your own product number, just add the Particle and Pore Size Code to the Phase Code: **[Phase]-[Particle and Pore]**
Example: S03205E-A for a C18 silica gel, 5 µm, 100 Å

Phase Codes

Silia*Sphere* Phase Codes	
Phase	Phase Code
C18	S032
C8	S308
Cyano	S380
Silica	S100

Particle and Pore Size Codes

Silia*Sphere* Particle and Pore Size Codes				
Particle Size	Pore Diameter			
	60 Å	100 Å	300 Å	1,000 Å
3 µm	03B	03E-A	03M	-
5 µm	05B	05E-A	05M	-
10 µm	07B	07E-A	07M	07T

Packed in Cartridges

Silia*Prep* SPE Cartridges and Silia*Sep* Flash Cartridges

To build your SPE or flash cartridge Product Number, simply start with the **Prefix SPE** or **FLH**, followed by the **Phase of the silica gel** you wish your cartridge to be packed with, followed by the **Format code**.

Examples:
- Silia*Prep* Cyano, 6 mL, 500 mg = SPE-R38030B-06P
- Silia*Sep* Open-Top Carbonate, 70 mL, 10 g = FLH-R66030B-70Y
- Silia*Sep* Thiol, 4 g = FLH-R51030B-ISO04

Silia*Prep* SPE and Silia*Sep* OT Cartridges

Formats available	Prefix	Code	Units / Box
3 mL / 200 mg	SPE	03G	50
3 mL / 500 mg	SPE	03P	50
6 mL / 500 mg	SPE	06P	50
6 mL / 1 g	SPE	06S	50
6 mL / 2 g	SPE	06U	50
12 mL / 2 g	SPE	12U	20
25 mL / 5 g*	FLH	20X	20
70 mL / 10 g*	FLH	70Y	16
70 mL / 15 g*	FLH	70i	16
70 mL / 20 g*	FLH	70Z	16
150 mL / 25 g*	FLH	95K	10
150 mL / 50 g*	FLH	95M	10
150 mL / 70 g*	FLH	95N	10

* Commercialized under Silia*Sep* OT branding.

Silia*Sep* Flash Cartridges

Formats available	Prefix	Code	Units / Box
4 g	FLH	ISO04	2
12 g	FLH	ISO12	1
25 g	FLH	ISO25	1
40 g	FLH	ISO40	1
80 g	FLH	ISO80	1
120 g	FLH	IS120	1
220 g	FLH	IS220	1
330 g	FLH	IS330	1
800 g	FLH	IS750	1
1,600 g	FLH	I1500	1

Silia*Chrom* Plus HPLC Columns Ordering Information

How to build your PN for HPLC Column: **HPLC-[Phase Code]-[Format Code]**
Example: HPLC-S03203E-A-N150 for a Silia*Chrom* Plus C18, 3 µm, 4.6 x 150 mm HPLC column

Phase Codes

Silia*Chrom* Plus Phase Codes

Phase	Particle Size		
	3 µm	5 µm	10 µm
C18	S03203E-A	S03205E-A	S03207E-A
C18-300	S03203M	S03205M	S03207M
C8	S30803E-A	S30805E-A	S30807E-A
C8-300	S30803M	S30805M	S30807M
Silica	S10003E-A	S10005E-A	S10007E-A
Silica-300	S10003M	S10005M	S10007M
Cyano	S38003E-A	S38005E-A	S38007E-A

Format Codes

Format Codes

Dimension	Qty/box	Code	3 µm	5 µm	10 µm
4.6 x 50 mm	1	N050	✓	✓	
4.6 x 100 mm	1	N100	✓	✓	
4.6 x 150 mm	1	N150	✓	✓	✓
4.6 x 250 mm	1	N250	✓	✓	✓
10 x 150 mm	1	Q150		✓	✓
10 x 250 mm	1	Q250		✓	✓
21.2 x 150 mm	1	T150		✓	✓
21.2 x 250 mm	1	T250		✓	✓
30 x 150 mm	1	V150		✓	✓
30 x 250 mm	1	V250		✓	✓
50 x 150 mm	1	W150			✓
50 x 250 mm	1	W250			✓

SILICYCLE
CERTIFIÉE I SO 9001:2015 CERTIFIED

We Redefine Purity

High Value Silica-based and Specialty Products for Organic Chemistry, Chromatography and Purification

DISCOVER AND DOWNLOAD OUR BROCHURES

METAL AND ORGANIC SCAVENGING

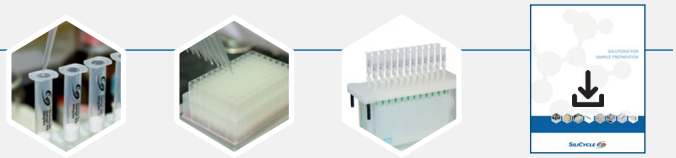
Silia*MetS*® – Metal Scavengers
Silia*Bond*® – Organic Scavengers
E-PAK® – Fixed Bed Flow-Through Purification Cartridges

CHROMATOGRAPHY AND PURIFICATION

Silia*Flash*® – Irregular Silica Gels | **Silia*Sphere*™ PC** – Spherical Silica Gels
Silia*Bond*® – Chromatographic Phases
Silia*Sep*™ – Flash Cartridges | **Silia*Plate*™** – TLC Plates

SAMPLE PREPARATION

Silia*Prep*™ – Silica-based SPE Cartridges and Well Plates
Silia*PrepX*™ – Polymeric SPE Cartridges and Well Plates



ANALYTICAL AND PREPARATIVE CHROMATOGRAPHY

Silia*Sphere*™ – Spherical Silica Gels
Silia*Chrom*® – HPLC Columns

ORGANIC SYNTHESIS

Silia*Bond*® – Reagents and Oxidants
Silia*Cat*® – 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**.

Email: **info@silicycle.com**

Phone: **+1 418.874.0054**

Toll Free: **+1 877.745.4292** (*North America only*)

Canadian Headquarters

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

www.silicycle.com

BRUNSCHWIG
www.chemie-brunschwig.ch
Email: **info@brunschwig-ch.com**