



SiliaBond[®]

Organic Scavengers





About SiliCycle

Founded in 1995, SiliCycle® Inc. is a worldwide leader in the development, the manufacturing and the commercialization of silica gel products for chromatography, analytical and organic chemistry. With our multi-ton manufacturing capability, we are your partner of choice for all your metal removal, catalysis, synthesis, and purification requirements.

Our business extends to more than fifty countries worldwide and our customer portfolio includes companies in the pharmaceutical, biotechnology industries, contract research and manufacturing organizations as well as university laboratories and hospital research centers.

The mission of SiliCycle is to develop and market innovative silica products of high value to customers and make a technical contribution to their work.

At SiliCycle, we are at the forefront of the chromatography industry, owing to the extraordinary purity of our silica gels and our capacity to rapidly adapt these gels to meet the specific requirements of pharmaceutical professionals and university scientists.

We lead the way in offering innovative products, such as SiliaCat® heterogeneous catalysts, SiliaMetS® Metal Scavengers, SiliaBond® functionalized silica gels, SiliaFlash® Irregular silica gels, IMPAQ® angular silica gels, SiliaSphere™ spherical silica gels, SiliaSep™ flash cartridges, SiliaPrep™ SPEs and Well Plates, SiliaPlate™ TLC plates, and SiliaChrom® HPLC columns.

We offer a wide variety of first-rate Ultra Pure Silica Gels. Our automated manufacturing process, which includes acid washing and multiple analyses, is continuously optimized to ensure high purity and a low percentage of fine particles, thereby guaranteeing optimal performance.

We are committed to provide the highest quality products and services in the industry.



Importance of Quality Control

The Quality Control Department's objective is to provide defect-free products. In light of this goal, we have determined the critical points that need to be addressed for each product line. These points are based on customer's and Account Managers' recommendations as well as on our employees' scientific knowledge.

Each product family has its own quality control procedures, which are strictly adhered to. QC test results are checked and confirmed by the person in charge of them before being cleared for shipping. Complete procedures for each product line are available upon request.

Thus, SiliCycle is committed to high quality standards. In doing so, every product meets the quality specifications our customers demand. All products are shipped with a Certificate of Analysis (CofA) and a sample from every batch is kept for subsequent analysis. If you feel that the product you have received does not meet these specifications, please contact us and we will make sure you are satisfied.

Bare Silica Gel

The backbone of most of SiliCycle's products is SiliFlash F60 (40-63 μm , 60 \AA) silica gel. It provides superior performance for chromatographic applications due to its narrow particle size distribution and high purity.

Before functionalization, every silica is rigorously characterized and analyzed by the procedures below to ensure lot-to-lot reproducibility.

Functionalized Silica Gel

The process for functionalizing the silica is highly dependent on the group being attached. However, it is still possible to functionalize 90% of the surface, verified by ^{29}Si MAS NMR. The remaining 10% of the surface may be endcapped to provide a completely inert support. After being functionalized, the product is submitted to further analysis and quality control as outlined below.

Quality Control	
Type of Analysis	Performed by:
Bare Silica Gel	
Carbon, nitrogen & sulfur content	Elemental analyzer
Total trace metal	ICP-OES
Surface area & porosity	Nitrogen adsorption analyzer
Particle size distribution	Laser light diffraction
Tapped density analysis	Density measurement
Water content	Moisture balance
pH	pH-meter
Functionalized Silica Gel	
Residual solvent content	Moisture balance
Specific reactivity analysis	GC-FID, GC-MS, LC-MS/MS, ICP-OES
Organic function signature	Infrared spectroscopy
Purity analysis	GC-MS



Analysis Descriptions

Elemental Analysis of Organic Compounds

SiliFlash silica gel has a very low organic content. All lots are subjected to elemental analysis to determine the carbon, nitrogen and sulfur levels.

Total Trace Metal Analysis

To improve the quality of the separation, SiliCycle manufactures silica gels with very low traces of metal content. All silica gels are analyzed for more than 45 metals by ICP-OES down to ppm, and reach up to 99.4% silica purity. This removes any issues from metal oxides that may act as Lewis acids and prevents «Tailing» of most polar compounds (*frequently ionizable*) that can be caused by silica with a high metal content.

Surface Area and Porosity Analysis

The efficiency and reliability of silica gel depend on its surface condition. We use the Brunauer, Emmet, and Teller analysis to determine the surface area, and the Barret-Joyner-Hatenda method to determine the pore diameter and pore volume. A larger surface area results in more contact or interaction with the analyte, thereby increasing the segregation of different products. Pore diameter and pore volume permit semi-exclusion chromatography where smaller molecules fit into pores more easily than larger ones. This justifies the use of several types of silica to achieve better discrimination in chromatographic separations.

Particle Size Distribution Analysis

Particle size distribution is determined by laser diffraction. Usually, more than 90% of the silica gel is kept within the appropriate range.

Water Content Analysis (*silica gel activity*)

The amount of water on the silica's surface affects chromatographic performance. An anhydrous silica gel will be extremely polar, while a wetted one will be considerably less polar. Every batch is carefully adjusted to a specific percentage of water content.

pH Analysis

The pH can increase the retention of some ionizable compounds. However, some products can become hydrolyzed or rearranged when in contact with acidic silica. A neutral pH, with a range between 6.5 and 7.5, is the most important factor in determining the reliability and inert behavior of the silica. This pH test involves suspending the silica gel in pure water (5% w/w).

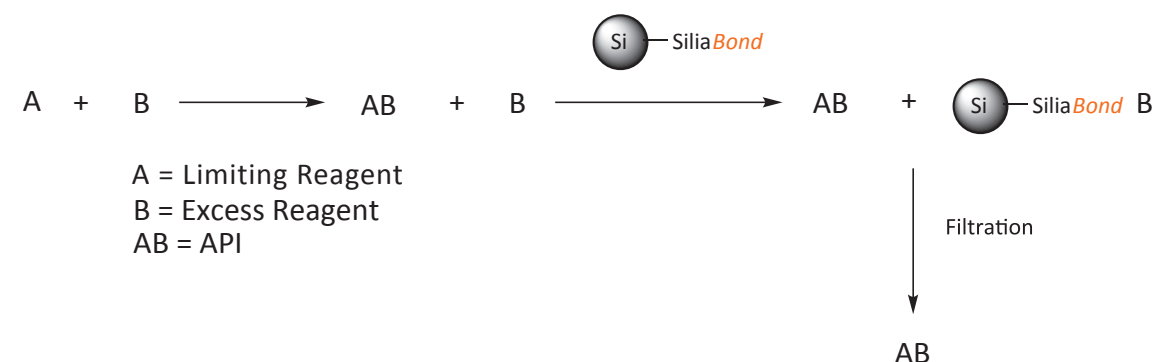


SiliaBond Organic Scavengers

SiliaBond Organic Scavengers can be Used for the Purification of API's in 2 Different Ways:

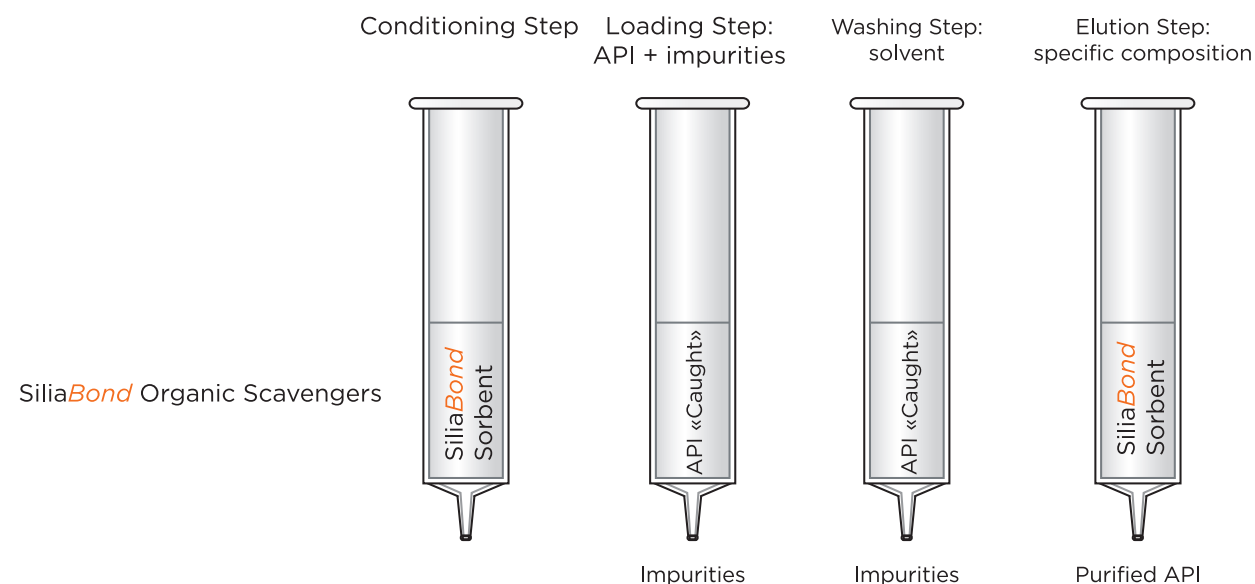
Scavenge Undesired Compounds to Isolate the API

This technique is used to trap the excess of reagent and/or the impurities on the silica matrix. The API is recovered by simple filtration as demonstrated on the following scheme.



Catch and Release of the API

This method is used in an SPE cartridge format where the API is caught on the silica matrix, then filtered to eliminate all other undesired components and finally released back in solution. The catch & release method is shown below.



Scavenging Undesired Compounds: Electrophile Scavengers

Electrophile Scavenger				
Function to be scavenged	Recommended Scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Acid chlorides or sulfonyl chlorides	SiliaBond Amine	1.6	<ul style="list-style-type: none"> Add 2 - 4 eq. of SiliaBond SiliaMetS to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to attain acid chloride-free solution 	All solvents
	SiliaMetS Diamine	1.4		All solvents
	SiliaMetS Triamine	1.2		All solvents
	SiliaBond DMAP	0.8		Organic solvents
	SiliaBond Piperazine	0.8		All solvents

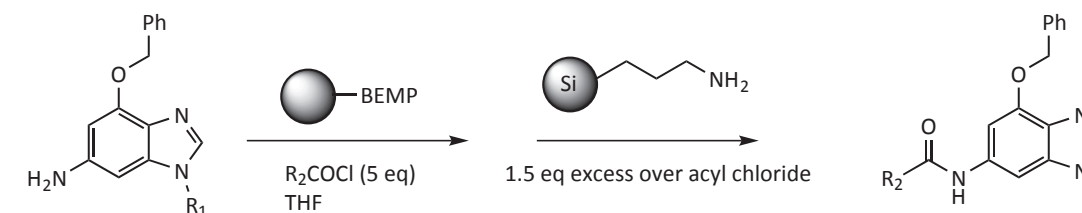
Scavenging Acid Chlorides with SiliaBond Amine

Sample Procedure

Add 1.5 eq of SiliaBond Amine to the reaction mixture, and stir for 1 h at room temperature.

Filter off the scavenger and rinse with solvent to yield acyl chloride free solution.

Related Publication: *J. Catal.*, 195, 2000, 412.



Electrophile Scavenger				
Function to be scavenged	Recommended Scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Aldehydes or carbonyls	SiliaBond Amine	1.6	<ul style="list-style-type: none"> Add 2 - 4 eq. of SiliaBond to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to yield aldehyde free solution (ketones and hindered aldehydes add 0.05 eq. of acetic acid) 	All solvents
	SiliaBond Tosyl Hydrazine	1.5		Aprotic and non carbonyl solvents

Scavenging Undesired Compounds: Electrophile Scavengers (con't)

Electrophile Scavenger				
Function to be scavenged	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Isocyanates	SiliaBond Amine	1.6	- Add 2 - 4 eq. of SiliaBond to the reaction mixture - Stir for 1 h at room temperature - Filter off the scavenger and wash with solvent to afford isocyanate free solution	All solvents
	SiliaMetS Diamine	1.4		All solvents
	SiliaMetS Triamine	1.2		All solvents
Anhydrides	SiliaBond Amine	1.6	- Add 2 - 4 eq. of SiliaBond to the reaction mixture - Stir for 1 h at room temperature - Filter off the scavenger and wash with solvent to afford anhydride free solution	All solvents
Chloroformates	SiliaBond Amine	1.6	- Add 2 - 4 eq. of SiliaBond to the reaction mixture - Stir for 1 h at room temperature - Filter off the scavenger and wash with solvent to afford chloroformate free solution	All solvents
	SiliaMetS Diamine	1.4		All solvents
	SiliaMetS Triamine	1.2		All solvents

Scavenging Undesired Compounds: Nucleophile Scavengers

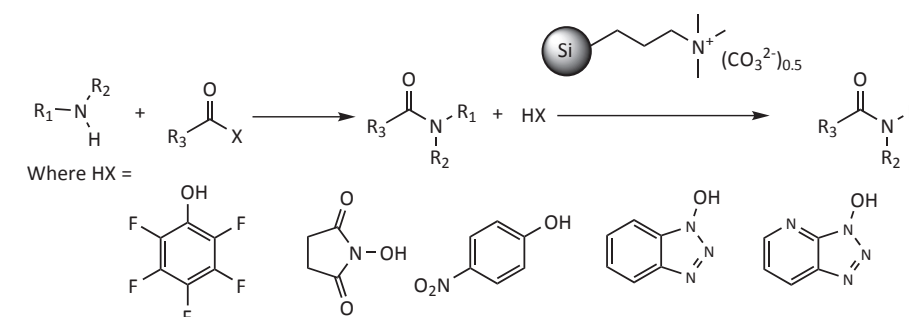
Nucleophile Scavenger				
Function to be scavenged	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Acids or acidic phenols	SiliaBond Amine	1.6	- Add 2 - 4 eq. of SiliaBond to the reaction mixture - Stir for 1 h at room temperature - Filter off the scavenger and wash with solvent to afford acid free solution	All solvents
	SiliaMetS Diamine	1.4		All solvents
	SiliaMetS Triamine	1.2		All solvents
	SiliaBond Carbonate	0.7		Organic solvents
	SiliaBond TBD	0.9		All solvents

Amine free basing using SiliaBond Carbonate

Trifluoroacetic acid (TFA) is certainly the most commonly used ion-pairing agent for the separation of peptides in reversed-phase chromatography. 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. SiliaBond Carbonate is an efficient and convenient solution to this problem. See page 180 of this catalog for more details.

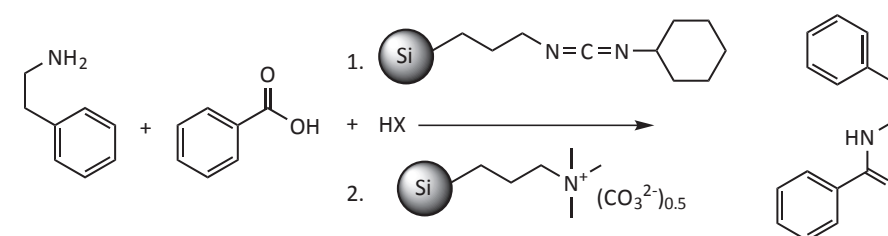
Scavenging phenols and acids with SiliaBond Carbonate

The efficiency of SiliaBond Carbonate as a scavenger of various coupling reagents (HX), including pentafluorophenol, N-hydroxysuccinimide (HOSu or NHS), 4-nitrophenol, 1-hydroxybenzotriazole (HOBT), and 1-hydroxy-7-azabenzotriazole (HOAt) is shown below, as well as a comparison with 2 suppliers of polymer-supported carbonate.



Scavenging Phenols Results						
HX	SiliaBond Carbonate		Polymer 1		Polymer 2	
	5 min	60 min	5 min	60 min	5 min	60 min
Pentafluorophenol ¹	2	2	8	5	15	6
N-Hydroxysuccinimide	7	< 5	59	36	60	58
4-Nitrophenol	6	4	11	5	23	12
1-Hydroxybenzotriazole ²	12	4	32	8	74	4
1-Hydroxy-7-azabenzotriazole ²	3	3	28	4	70	8

Initial concentration: 5,000 ppm - 3 eq. of SiliaBond Carbonate. Analyzed by UV. ¹ Analyzed by GC-MS, ² in THF



Amide Coupling Results		
HX	Yield (%)	Purity (%)
No Catalyst	35.4	95.1
Hydroxysuccinimide ¹	67.2	98.0
1-Hydroxybenzotriazole ²	98.9	97.7
1-Hydroxy-7-azabenzotriazole ²	100	99.2

1.0 eq. of amine, 1.5 eq. acid, 1.7 eq. catalyst (HX), 2.0 eq. SiliaBond Carbodiimide, 7.0 eq. SiliaBond Carbonate. Yield refers to the mass of isolated product. Purity was determined by GC-FID. ¹ in DCM, ² in THF

Related publication

- P. Wipf et al., *Tetrahedron*, 61, 2005, 11488.
 B. Desai et al., *Tetrahedron*, 62, 2006, 4651.
 S. Mao et al., *J. Comb. Chem.*, 10, 2008, 235.
 T. Emmerich et al., *Bioorg. Med. Chem. Lett.*, 20, 2010, 232.
 D. R. Saueur et al., *Org. Lett.*, 5, 2003, 4721.
 S. Werner et al., *J. Comb. Chem.*, 9, 2007, 677.

Scavenging Undesired Compounds: Nucleophile Scavengers (con't)

Nucleophile Scavenger				
Function to be scavenged	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Alcohols	SiliaBond Tosyl Chloride	1.0	<ul style="list-style-type: none"> Add 2 - 4 eq of SiliaBond to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to remove alcohol from solution 	Anhydrous aprotic solvents and unstable in DMF
Alkoxides	SiliaBond Tosyl Chloride	1.0	<ul style="list-style-type: none"> Add 2 - 4 eq of SiliaBond to the reaction mixture Stir for 1 h at room temperature 	Anhydrous aprotic solvents and unstable in DMF Anhydrous aprotic organic solvents
	SiliaBond Isocyanate	1.2	<ul style="list-style-type: none"> Filter off the scavenger and wash with solvent to obtain alkoxide-free solution 	
Amines (primary, secondary or anilines)	SiliaBond Carboxylic Acid	1.4	<ul style="list-style-type: none"> Add 2 - 4 eq of SiliaBond to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to remove amine from solution 	All solvents
	SiliaBond Tonic Acid	0.8		All solvents
	SiliaBond Propylsulfonic Acid	1.0		All solvents
	SiliaBond Isocyanate	1.2		Anhydrous aprotic organic solvents
	SiliaBond Tosyl Chloride	1.0		Anhydrous aprotic organic solvents

Scavenging of amine with SiliaBond Isocyanate

Scavenging Amines Results			
Scavenger	Benzylamine	Aniline	
SiliaBond Isocyanate	98.7	94.4	
Polymer 1	100	98.9	
Polymer 2	100	99.2	

Conditions: 3 eq. relative to amine, 1 h at room temperature in DCE
% scavenged determined by GC-MS

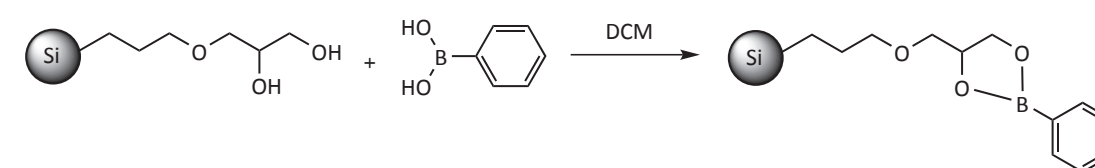
Scavenging of benzylamines with SiliaBond Isocyanate in different solvents

Scavenging Benzylamine Results				
Scavenger	THF	DCM	ACN	
SiliaBond Isocyanate	> 98%	> 98%	95%	
Polymer 1	> 98%	> 98%	79%	
Polymer 2	> 98%	> 98%	88%	

Conditions: 3 eq. relative to amine, 1 h at room temperature
% scavenged determined by GC-MS

Nucleophile Scavenger				
Function to be scavenged	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Boronic acids	SiliaBond Carbonate	0.7	<ul style="list-style-type: none"> Add 2-4 eq of SiliaBond to the reaction mixture 	Organic solvents
	SiliaBond Diol	1.0	<ul style="list-style-type: none"> Stir for 1 h at room temperature 	All solvents
	SiliaBond TBD	0.9	<ul style="list-style-type: none"> Filter off the scavenger and wash with solvent to yield boronic acid-free solution 	All solvents

Scavenging boronic acids with SiliaBond Diol



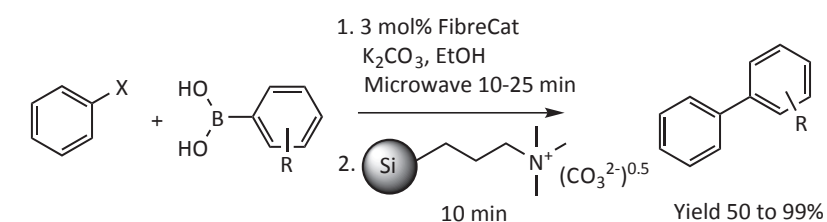
Scavenging Boronic acids Results		
Equivalent	Time	Efficiency
2	1 h	75%
4	1 h	100%

Conditions: 2-4 eq. relative to boronic acid, 1 h at room temperature
% scavenged determined by GC-MS

Scavenging boronic acids with SiliaBond Carbonate

Related publication

Y. Wang and D. R. Sauer, *Org. Lett.*, 6, 2004, 2793.



Scavenging Boronic acids Results				
Equivalent	Structure 1	Structure 2	Structure 3	Structure 4
10	100%	100%	100%	100%

Scavenging Undesired Compounds: Nucleophile Scavengers (con't)

Nucleophile Scavenger				
Function to be scavenged	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions	Solvent compatibility
Hydrazines	SiliaBond Tosyl Chloride	1.0	<ul style="list-style-type: none"> Add 2 - 4 eq. of SiliaBond to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to remove hydrazine from solution 	Anhydrous aprotic solvents Unstable in DMF
Organometallics	SiliaBond Tosyl Chloride	1.0	<ul style="list-style-type: none"> Add 2 - 4 eq. of SiliaBond to the reaction mixture Stir for 1 h at room temperature Filter off the scavenger and wash with solvent to obtain organometallic-free solution 	Anhydrous aprotic solvents Unstable in DMF
Thiol or thiolates	SiliaBond Isocyanate	1.2	<ul style="list-style-type: none"> Add 2 - 4 eq. of SiliaBond to the reaction mixture Stir for 1 h at room temperature 	Anhydrous aprotic organic solvents
	SiliaBond Maleimide (thiol)	0.7	<ul style="list-style-type: none"> Filter off the scavenger and wash with solvent to yield thiol-free solution 	Polar solvents (DMF, MeOH and H ₂ O)



Catch and Release of the API

Catch and Release the API			
Function to be isolated	Recommended SiliaBond scavenger	Loading (mmol/g)	Typical conditions
Amines	SiliaBond Tosic Acid (SCX)	0.8	<ul style="list-style-type: none"> Catch the amine on the SiliaBond Wash with methanol Release with a solution of 2 M NH₃ in methanol
	SiliaBond Propylsulfonic acid (SCX-2)	1.0	
Carboxylic acids	SiliaBond TMA Acetate (SAX-2)	1.0	<ul style="list-style-type: none"> Catch the carboxylic acid on the SiliaBond Wash with methanol Release with 2% AcOH in MeOH or 1% HCl in ACN

Scavenging 2-Iodobenzoic Acid using SiliaBond TMA Acetate and Carbonate

Dess Martin Periodinane (DMP) is a mild and chemoselective oxidant. It is readily accessible, environmentally benign and has a good shelf-life. Further, the ease of handling, simple reaction work-up, product purification and good yields obtained with DMP make it a valuable reagent in organic synthesis.

2-Iodobenzoic acid is the degradation product from DMP formed during the work-up. Most of it can be removed with a basic work-up, but sometimes, it can be difficult to get rid of all this side product.

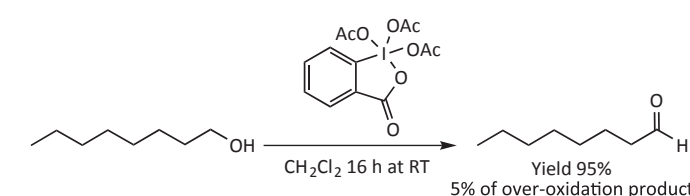
General Procedure

A solution of 1-octanol (1 mmol) in CH₂Cl₂ (6 mL) at room temperature, was added to DMP (1.1 mmol). The reaction mixture was stirred for 16 h, then diluted with 35 mL of MTBE and poured in 20 mL of an aqueous

solution of Na₂S₂O₃ (25%). The mixture was stirred for 10 min. Another portion of 35 mL of MTBE was added for the liquid-liquid extraction. The MTBE phase was then washed with water¹ and a saturated aqueous solution of NaCl (10 mL) and dried on MgSO₄.

Scavenging was done using SiliaBond TMA Acetate or Carbonate, both in bulk (1 g) and SPE cartridge (6 mL/1 g) for comparison purposes. Each sample was washed or eluted with a fresh portion of MTBE (8 mL) and then the 2-iodobenzoic acid was monitored by GC-MS against an internal standard. Over-oxidation product (carboxylic acid) was scavenged with SiliaBond scavengers.

¹The usual NaHCO₃ wash was intentionally omitted in order to get significant amount of residual 2-iodobenzoic acid in the final solution.

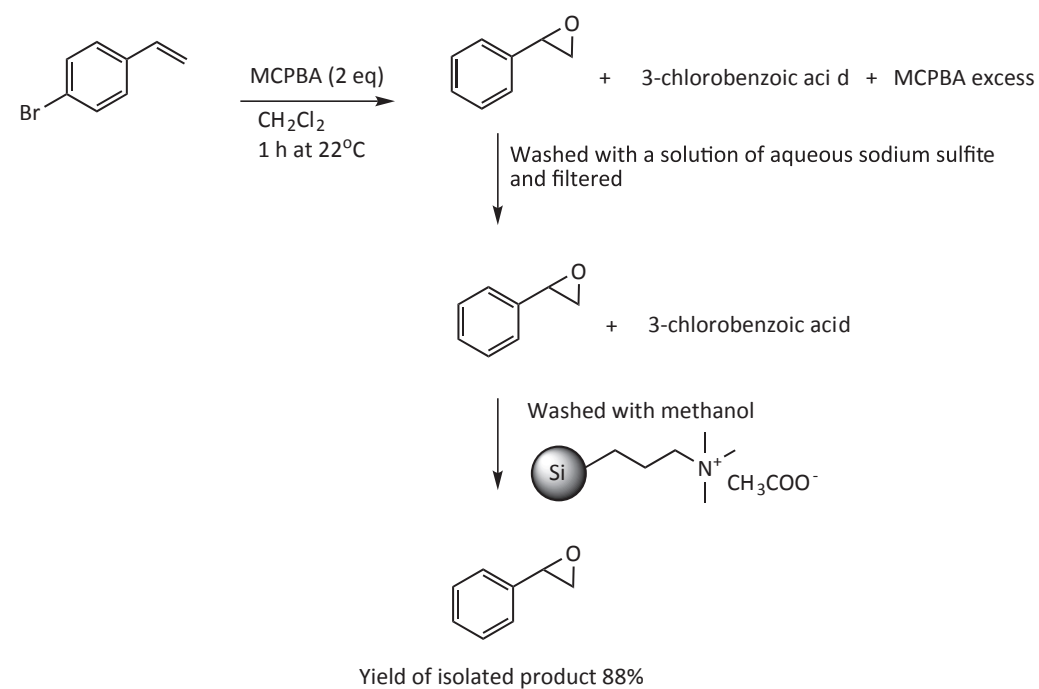


Scavenging 2-Iodobenzoic acid Results (%)

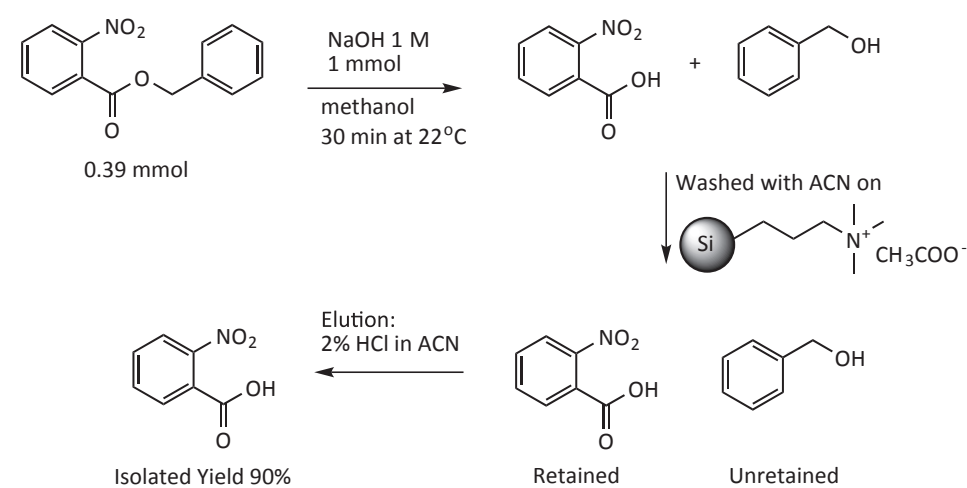
Sorbent	Bulk	SiliaPrep
SiliaBond TMA Acetate	100	100
SiliaBond Carbonate	100	100

Catch and Release of the API (con't)

Ester hydrolysis purification using SiliaBond TMA Acetate

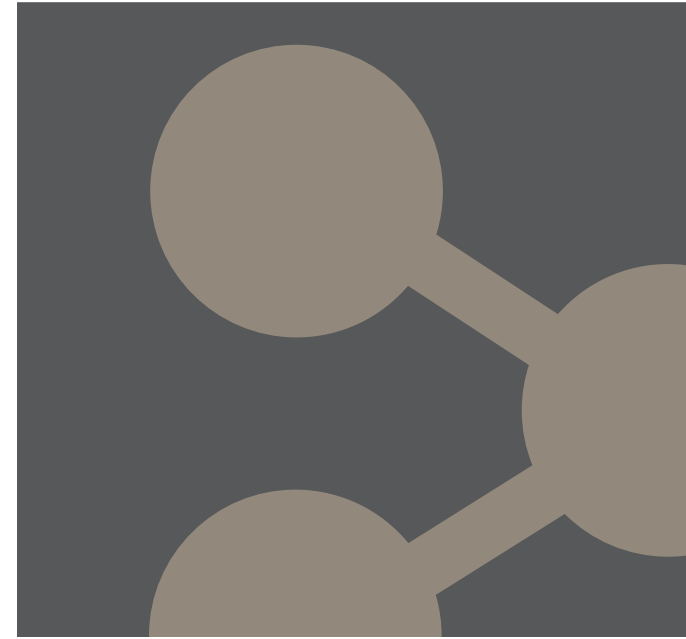


Ester hydrolysis purification using SiliaBond TMA Acetate



SiliaBond Ordering Information

SiliaBond Organic Scavenger Part Numbers		
Scavenger	Part Number	Available Quantity
SiliaBond Amine	R52030B	
SiliaBond Carbonate	R66030B	
SiliaBond Carboxylic Acid	R70030B	5 g
SiliaMetS Diamine	R49030B	10 g
SiliaBond Diol	R35030B	25 g
SiliaBond DMAP	R75530B	50 g
SiliaBond Isocyanate	R50030B	100 g
SiliaBond Maleimide	R71030B	250 g
SiliaBond Piperazine	R60030B	500 g
SiliaBond Propylsulfonic Acid	R51230B	1 kg
SiliaBond TBD	R68530B	5 kg
SiliaBond TMA Acetate	R66430B	10 kg
SiliaBond Tosic Acid	R60530B	25 kg
SiliaBond Tosyl Chloride	R44030B	...
SiliaBond Tosyl Hydrazine	R61030B	Multi-Ton
SiliaMetS Triamine	R48030B	Call us for details



Contact Us
Order Now

Ordering Information

Quote Form

General Information

Company:

SiliCycle Customer Number (if known):

Contact Name:

E-mail address:

Tel: Fax:

Address Information

.....

Department:

Address:

ZIP/Postal Code:

Country:

Quote Request		
Part Number	Product Description	Request Quantity

Confirm this request by

- FAX
- E-mail
- Phone

Comments

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Information Request Form

- | | | |
|---|---|--|
| <input type="checkbox"/> Metal Scavengers
Metal of interest:
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..... | <input type="checkbox"/> Catalysts
<input type="checkbox"/> SiliaCat catalysts
<input type="checkbox"/> SiliaBond catalysts
<input type="checkbox"/> SiliaCat + SiliaBond catalysts | <input type="checkbox"/> Oxidants
<input type="checkbox"/> SiliaCat oxidant
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<input type="checkbox"/> SiliaCat + SiliaBond oxidants |
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| <input type="checkbox"/> Organic scavengers
<input type="checkbox"/> Nucleophile scavengers
<input type="checkbox"/> Electrophile scavengers
<input type="checkbox"/> Genotoxic scavengers | <input type="checkbox"/> SiliaBond Reagents
<input type="checkbox"/> Reaction of interest
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<input type="checkbox"/> Normal phases
<input type="checkbox"/> Fluorous phases
<input type="checkbox"/> Ion exchangers | <input type="checkbox"/> HPLC Columns
<input type="checkbox"/> Reversed phases
<input type="checkbox"/> Normal phases
<input type="checkbox"/> Ion exchangers
<input type="checkbox"/> Chiral phases | <input type="checkbox"/> Application notes in
<input type="checkbox"/> Bulk
<input type="checkbox"/> SPE cartridges
<input type="checkbox"/> Flash cartridges |
|---|---|---|

General Information

Company:

SiliCycle Customer Number (if known):

Contact Name:

E-mail address:

Tel: Fax:

Address Information

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Department:

Address:

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Comments

.....

 Please Copy and Fax this form to SiliCycle Inc. at **418-874-0355**



Order Form

General Information

Company:
 SiliCycle Client Number: Purchase Order Number:
 Contact Name:
 E-mail address:
 Tel: Fax:

Payment Details

Verification Code*

Credit card number: *The 3 last numbers in the back side of your card
 Expiry date:
 Name as it appears on card:
 VISA Master Card Amex



Address Information for the Shipment

Department:
 Address:
 ZIP/Postal Code:
 Country:

SiliCycle Products				
Part Number	Product Description	Packaging (g, Kg, box)	Quantity	Price (USD)

Confirm this request by

- FAX
- E-mail
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Comments

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 Please Copy and Fax this form to SiliCycle Inc. at **418-874-0355**

Ordering Information

How to order

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Orders can also be placed by phone, fax, mail or e-mail. You will find an order form on page 222 of this catalog for fax (1 418.874.0355) and mail (SiliCycle headquarters address at the bottom of this page) orders. If you prefer, you can reach us by e-mail (info@silicycle.com) or by phone (1 418.874.0054 or Toll free for North America only 1 877.745.4292). Please have the following information on hand:

- Your name
- Company name, billing and shipping address
- Purchase order number
- Credit card information
- Catalog number and product description
- Size, quantity and unit of measure
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Technical Support

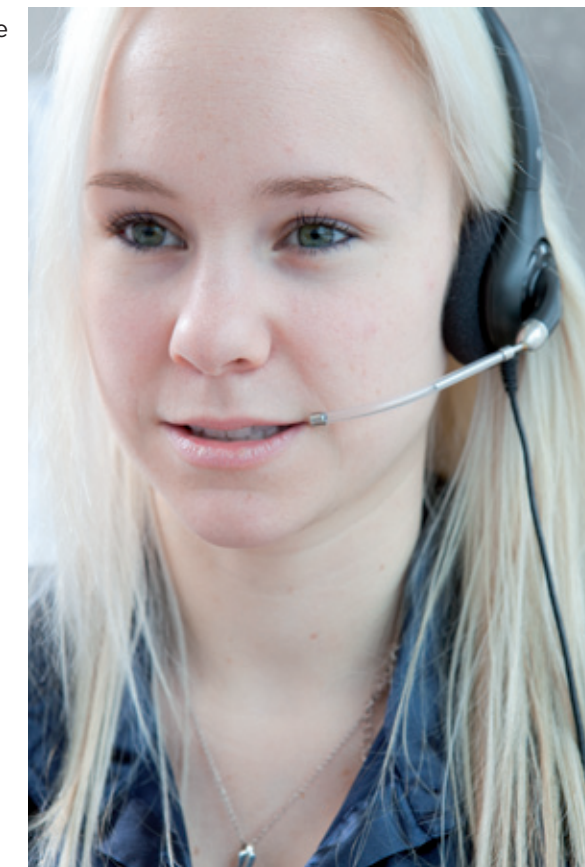
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In order to better respond to your technical inquiries, feel free to contact us in three different ways:

- E-mail: support@silicycle.com
- Phone: International 1 418.874.0054
- Canada USA 1 877.745.4292 (Toll-Free)
- Online forum at www.SiliCycle.com

SiliCycle headquarters address:

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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.





As a recognized industry leader in the development, manufacturing and commercialization of innovative silica gel products, and with multi-ton manufacturing capability, SiliCycle® is your partner of choice for all your **metal removal**, **catalysis**, **synthesis**, and **purification** requirements.

SiliaMets®
Metal Scavengers



- No leaching: no API contamination
- High selectivity: total recovery of the API
- Very good metal affinity: efficient for a wide range of metal catalysts
- Solvent compatibility: can be used in any any solvents (pH 2 to 12)
- Fast kinetic even at room temperature
- Easily scalable
- Thermally and mechanically stable
- Ease of use and flexible formats
- Cost efficient: low cost per gram of metal scavenged
- Available in large quantities (**multi-ton scale**)

SiliaCat®
Heterogeneous Catalysts



- Wide range of organic coupling and hydrogenation reactions (**Suzuki, Sonogashira, Heck, and Stille**)
- SiliaCat silica-supported catalysts for cleaner products and cleaner waste streams
- Ideal for batch or flowthrough applications
- Cost efficient and highly stable
- Reusable and leach proof
- Available in sizes ranging from grams to multi-kilograms quantities

SiliaBond® C18
Chromatographic Phase



- Unmatched quality and performance
- Very highly hydrophobic C18 phase
- A homogeneous functionalized layer
- A unique grafting method ensuring reproducible results
- An unprecedented endcapping efficiency
- Incomparable lot-to-lot reproducibility
- The quality of a monofunctional C18
- Available in large quantities (**multi-ton scale**)

SiliaBond®
Functionalized Silica Gels



- No leaching (chemical stability)
- Selective nucleophile and electrophile scavengers
- High resolution chromatographic phases
- **Supported reagents** for organic synthesis
- Thermally stable and microwave compatible
- Available in large quantities (**multi-ton scale**)

SiliaChrom®
HPLC Columns



- Broad pH range (0,8-12,0)
- High surface coverage
- Wide variety of chemistries available
- Excellent column efficiency
- Long column lifetime
- Low bleed

SiliaPlate™
TLC Plates



- Analytical and preparative TLC plates
- Different sizes and choice of backings
- Normal, reversed and specialty phases

SiliaFlash®
Irregular Silica Gels



- High purity irregular Gel
- Tight particle size distribution
- Very low level of fines
- Neutral pH, low metal content, and controlled water level content
- Lot-to-lot reproducibility

SiliaSep™
Flash Cartridges



- High resolution & reproducibility
- Ultra high performance cartridges available (**SiliaSep HP**)
- Compatible with all commercial systems
- Reversed and specialty phases available

SiliaSphere™
Spherical Silica Gels



- Very high purity & tight particle size distribution
- Low metal content
- High mechanical stability
- Wide choice of phases available (normal, reversed & specialty)

SiliaPrep™
Solid Phase Extraction



- Wide choice of SPE cartridge formats, 96-well plates
- Normal, reversed, fluorinated, ion exchange , and mixed-mode phases
- Certified & Specialty phases (scavengers, reagents, etc.)

