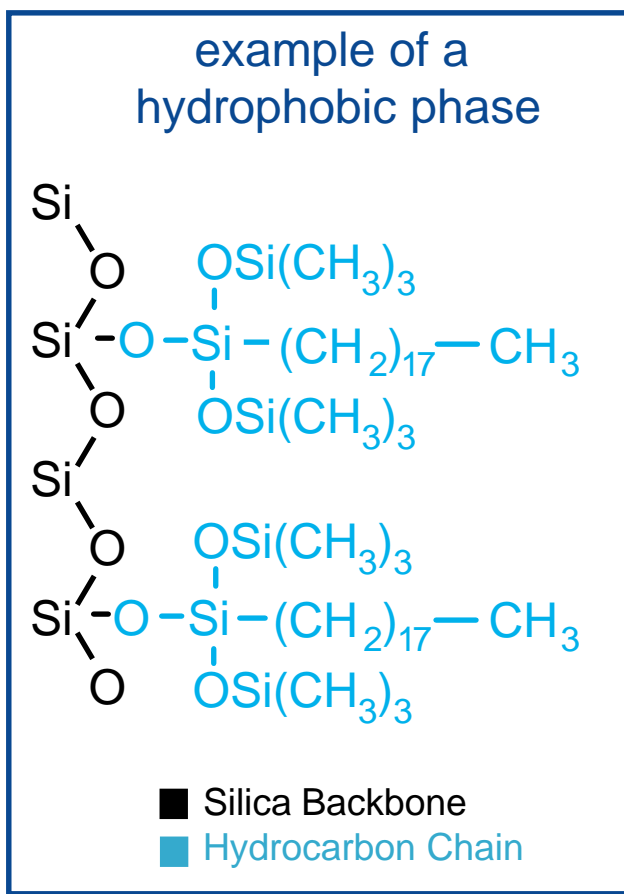


CLEAN-UP[®] Hydrophobic Extraction Columns

This sorbent is composed of a silica backbone bonded with hydrocarbon chains. It is used to extract compounds which exhibit non-polar or neutral characteristics out of complex matrices. The C18 phase is the most widely used for non-polar interactions because of its non-selective nature; C18 will extract a large number of compounds with differing chemical properties. To enhance selectivity, UCT offers a wide range of hydrophobic sorbents, from C2 to C20. Multiple chain configurations are available for some sorbents. Endcapped or unendcapped sorbents are available for all chain lengths.





Analytes*	Washes	Elutions
alkanes alkenes aromatics neutral compounds	aqueous, usually with some polar organic solvent	non-polar to polar organic

*typical compounds which can be extracted using hydrophobic columns

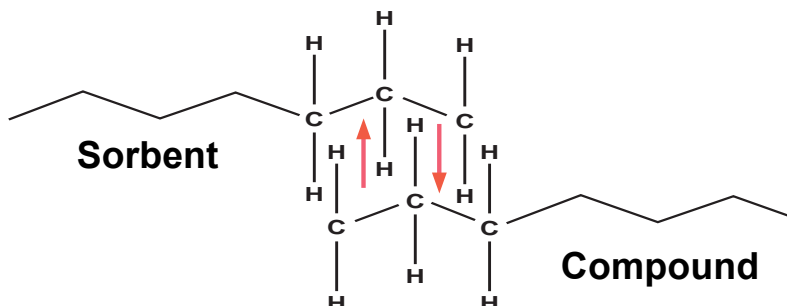
Mechanism of Hydrophobic Bonding

Compounds are retained by non-polar interactions from polar solvents or matrix environments. They are bound by dispersion forces / van der Waals forces. Elution, or disruption of the non-polar interactions is achieved by solvents or solvent mixtures with sufficient non-polar character. Some polar solvents, such as acetonitrile have enough non-polar characteristics to disrupt non-polar binding to cause elution of a compound from the sorbent. Methanol can be used as well, although it should be noted that it will take off both polar & non-polar analytes of interest & interferences.

Hydrophobic Sorbents & Structures

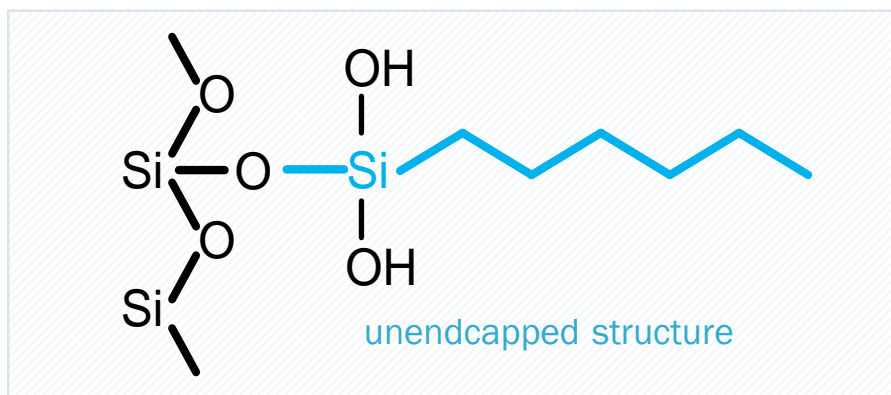
Sorbent	Structure
C2 ethyl	SiCH ₂ CH ₃
C3 propyl	Si(CH ₂) ₂ CH ₃
C4 n-butyl	Si(CH ₂) ₃ CH ₃
iC4 isobutyl	SiCH ₂ CH(CH ₃) ₂
tC4 tertiary butyl	SiC(CH ₃) ₃
C5 pentyl	Si(CH ₂) ₄ CH ₃
C6 hexyl	Si(CH ₂) ₅ CH ₃
C7 heptyl	Si(CH ₂) ₆ CH ₃
C8 octyl	Si(CH ₂) ₇ CH ₃
C10 decyl	Si(CH ₂) ₉ CH ₃
C12 dodecyl	Si(CH ₂) ₁₁ CH ₃
C18 octadecyl	Si(CH ₂) ₁₇ CH ₃
C20 eicosyl	Si(CH ₂) ₁₉ CH ₃
Cyclohexyl	Si — 
Phenyl	Si — 

example of hydrophobic bonding

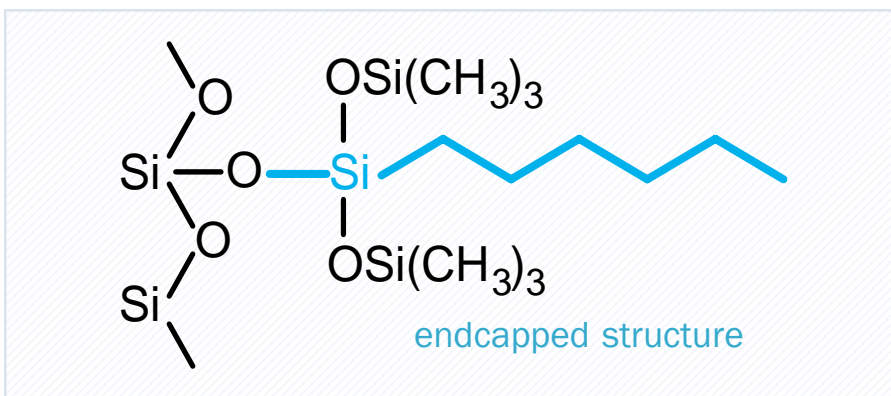


Unendcapped vs. Endcapped

Bonded phases are manufactured by the reaction of organosilanes with activated silica. During the polymerization reaction of carbon chains to the silica backbone, a very stable silyl ether linkage forms. Our unendcapped columns allow hydroxyl sites to remain, thus making these columns slightly hydrophilic.



In order to decrease this slight polarity, these hydroxyl sites are deactivated. Proprietary bonding techniques ensure that these sites are 100% reacted, leading to a complete endcapping. Because there are no hydroxyl sites left, our endcapped columns are more hydrophobic than our unendcapped columns.



How to read CLEAN-UP[®] part numbers

CLEAN-UP [®] CODE			
<h1>CUQAX25M25</h1>		Column size (ml) Z: 10ml Column	
CE: Endcapped CLEAN-UP [®] Column CU: Unendcapped CLEAN-UP [®] Column	Sorbent type*	Packing size (x100mg) ("M" signifies x 1,000 mg) ("L" signifies 50mg)	
CUQAX25M25: "CLEAN-UP [®] Quaternary amine anion exchange column dual phase anion exchanger plus a hydrophobic phase, 5,000mg/25ml (unendcapped)." 		SINGLE & DUAL PHASE 1: Column contains given sorbent type. 2: Column contains given sorbent plus a hydrophobic phase.	

*Sorbent Type:

C02-C20	Carbon chains
SIL	Unbonded Silica
PSA	n-2 Aminoethyl
BCX	Benzenesulfonic Acid cation exchanger
PCX	Propylsulfonic Acid cation exchanger
CCX	Carboxylic Acid cation exchanger
QAX	Quaternary amine anion exchanger
DAX	Diethylamino anion exchanger
NAX	Aminopropyl anion exchanger
CNP	Cyanopropyl
CYN	Cyclohexyl
DOL	Diol
PHY	Phenyl
DAU	"Drugs of Abuse" Sorbent
THC	"THC" Sorbent

CLEAN-UP[®]

Hydrophobic Product Guide

C18, OCTADECYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unendcapped		
CEC181L1	CUC181L1	50mg/1ml	100
CEC18111	CUC18111	100mg/1ml	100
CEC18113	CUC18113	100mg/3ml	50
CEC18123	CUC18123	200mg/3ml	50
CEC18153	CUC18153	500mg/3ml	50
CEC18156	CUC18156	500mg/6ml	50
CEC1811Z	CUC1811Z	100mg/10ml	50
CEC1812Z	CUC1812Z	200mg/10ml	50
CEC1815Z	CUC1815Z	500mg/10ml	50
CEC181M6	CUC181M6	1g/6ml	30
CEC1812M15	CUC1812M15	2g/15ml	20
CEC1815M25	CUC1815M25	5g/25ml	20
CEC18110M75	CUC18110M75	10g/75ml	10

C2, ETHYL

CEC021L1	CUC021L1	50mg/1ml	100
CEC02111	CUC02111	100mg/1ml	100
CEC02123	CUC02123	200mg/3ml	50
CEC02153	CUC02153	500mg/3ml	50
CEC02156	CUC02156	500mg/6ml	50
CEC0211Z	CUC0211Z	100mg/10ml	50
CEC0212Z	CUC0212Z	200mg/10ml	50
CEC0215Z	CUC0215Z	500mg/10ml	50
CEC021M6	CUC021M6	1g/6ml	30
CEC0212M15	CUC0212M15	2g/15ml	20
CEC0215M25	CUC0215M25	5g/25ml	20
CEC02110M75	CUC02110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

nC3, PROPYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unencapped		
CECn31L1	CUCn31L1	50mg/1ml	100
CECn3111	CUCn3111	100mg/1ml	100
CECn3123	CUCn3123	200mg/3ml	50
CECn3153	CUCn3153	500mg/3ml	50
CECn3156	CUCn3156	500mg/6ml	50
CECn311Z	CUCn311Z	100mg/10ml	50
CECn312Z	CUCn312Z	200mg/10ml	50
CECn315Z	CUCn315Z	500mg/10ml	50
CECn31M6	CUCn31M6	1g/6ml	30
CECn312M15	CUCn312M15	2g/15ml	20
CECn315M25	CUCn315M25	5g/25ml	20
CECn3110M75	CUCn3110M75	10g/75ml	10

nC4, n-BUTYL

CECn41L1	CUCn41L1	50mg/1ml	100
CECn4111	CUCn4111	100mg/1ml	100
CECn4123	CUCn4123	200mg/3ml	50
CECn4153	CUCn4153	500mg/3ml	50
CECn4156	CUCn4156	500mg/6ml	50
CECn411Z	CUCn411Z	100mg/10ml	50
CECn412Z	CUCn412Z	200mg/10ml	50
CECn415Z	CUCn415Z	500mg/10ml	50
CECn41M6	CUCn41M6	1g/6ml	30
CECn412M15	CUCn412M15	2g/15ml	20
CECn415M25	CUCn415M25	5g/25ml	20
CECn4110M75	CUCn4110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

iC4, ISOBUTYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unendcapped		
CECi41L1	CUCi41L1	50mg/1ml	100
CECi4111	CUCi4111	100mg/1ml	100
CECi4123	CUCi4123	200mg/3ml	50
CECi4153	CUCi4153	500mg/3ml	50
CECi4156	CUCi4156	500mg/6ml	50
CECi411Z	CUCi411Z	100mg/10ml	50
CECi412Z	CUCi412Z	200mg/10ml	50
CECi415Z	CUCi415Z	500mg/10ml	50
CECi41M6	CUCi41M6	1g/6ml	30
CECi412M15	CUCi412M15	2g/15ml	20
CECi415M25	CUCi415M25	5g/25ml	20
CECi4110M75	CUCi4110M75	10g/75ml	10

tC4, TERTIARY BUTYL

CECt41L1	CUCt41L1	50mg/1ml	100
CECt4111	CUCt4111	100mg/1ml	100
CECt4123	CUCt4123	200mg/3ml	50
CECt4153	CUCt4153	500mg/3ml	50
CECt4156	CUCt4156	500mg/6ml	50
CECt411Z	CUCt411Z	100mg/10ml	50
CECt412Z	CUCt412Z	200mg/10ml	50
CECt415Z	CUCt415Z	500mg/10ml	50
CECt41M6	CUCt41M6	1g/6ml	30
CECt412M15	CUCt412M15	2g/15ml	20
CECt415M25	CUCt415M25	5g/75ml	20
CECt4110M75	CUCt4110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

C5,PENTYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unendcapped		
CEC051L1	CUC051L1	50mg/1ml	100
CEC05111	CUC05111	100mg/1ml	100
CEC05123	CUC05123	200mg/3ml	50
CEC05153	CUC05153	500mg/3ml	50
CEC05156	CUC05156	500mg/6ml	50
CEC0511Z	CUC0511Z	100mg/10ml	50
CEC0512Z	CUC0512Z	200mg/10ml	50
CEC0515Z	CUC0515Z	500mg/10ml	50
CEC051M6	CUC051M6	1g/6ml	30
CEC0512M15	CUC0512M15	2g/15ml	20
CEC0515M25	CUC0515M25	5g/25ml	20
CEC05110M75	CUC05110M75	10g/75ml	10

C6, HEXYL

CEC061L1	CUC061L1	50mg/1ml	100
CEC06111	CUC06111	100mg/1ml	100
CEC06123	CUC06123	200mg/3ml	50
CEC06153	CUC06153	500mg/3ml	50
CEC06156	CUC06156	500mg/6ml	50
CEC0611Z	CUC0611Z	100mg/10ml	50
CEC0612Z	CUC0612Z	200mg/10ml	50
CEC0615Z	CUC0615Z	500mg/10ml	50
CEC061M6	CUC061M6	1g/6ml	30
CEC0612M15	CUC0612M15	2g/15ml	20
CEC0615M25	CUC0615M25	5g/25ml	20
CEC06110M75	CUC06110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

C7, HEPTYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unendcapped		
CEC071L1	CUC071L1	50mg/1ml	100
CEC07111	CUC07111	100mg/1ml	100
CEC07123	CUC07123	200mg/3ml	50
CEC07153	CUC07153	500mg/3ml	50
CEC07156	CUC07156	500mg/6ml	50
CEC0711Z	CUC0711Z	100mg/10ml	50
CEC0712Z	CUC0712Z	200mg/10ml	50
CEC0715Z	CUC0715Z	500mg/10ml	50
CEC071M6	CUC071M6	1g/6ml	30
CEC0712M15	CUC0712M15	2g/15ml	20
CEC0715M25	CUC0715M25	5g/25ml	20
CEC07110M75	CUC07110M75	10g/75ml	10

C8, OCTYL

CEC081L1	CUC081L1	50mg/1ml	100
CEC08111	CUC08111	100mg/1ml	100
CEC8113	CUC08113	100mg/3ml	50
CEC08123	CUC08123	200mg/3ml	50
CEC08153	CUC08153	500mg/3ml	50
CEC08156	CUC08156	500mg/6ml	50
CEC0811Z	CUC0811Z	100mg/10ml	50
CEC0812Z	CUC0812Z	200mg/10ml	50
CEC0815Z	CUC0815Z	500mg/10ml	50
CEC081M6	CUC081M6	1g/6ml	30
CEC0812M15	CUC0812M15	2g/15ml	20
CEC0815M25	CUC0815M25	5g/25ml	20
CEC08110M75	CUC08110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

C10, nDECYL

endcapped	part number	amount sorbent/ unencapped	tube volume	units per pack
CEC101L1	CUC101L1		50mg/1ml	100
CEC10111	CUC10111		100mg/1ml	100
CEC10123	CUC10123		200mg/3ml	50
CEC10153	CUC10153		500mg/3ml	50
CEC10156	CUC10156		500mg/6ml	50
CEC1011Z	CUC1011Z		100mg/10ml	50
CEC1012Z	CUC1012Z		200mg/10ml	50
CEC1015Z	CUC1015Z		500mg/10ml	50
CEC101M6	CUC101M6		1g/6ml	30
CEC1012M15	CUC1012M15		2g/15ml	20
CEC1015M25	CUC1015M25		5g/25ml	20
CEC10110M75	CUC10110M75		10g/75ml	10

C12, nDODECYL

CEC121L1	CUC121L1		50mg/1ml	100
CEC12111	CUC12111		100mg/1ml	100
CEC12123	CUC12123		200mg/3ml	50
CEC12153	CUC12153		500mg/3ml	50
CEC12156	CUC12156		500mg/6ml	50
CEC1211Z	CUC1211Z		100mg/10ml	50
CEC1212Z	CUC1212Z		200mg/10ml	50
CEC1215Z	CUC1215Z		500mg/10ml	50
CEC121M6	CUC121M6		1g/6ml	30
CEC1212M15	CUC1212M15		2g/15ml	20
CEC1215M25	CUC1215M25		5g/25ml	20
CEC12110M75	CUC12110M75		10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

C20, EICOSYL

part number		amount sorbent/ unencapped	tube volume	units per pack
encapped				
CEC201L1	CUC201L1	50mg/1ml	100	
CEC20111	CUC20111	100mg/1ml	100	
CEC20123	CUC20123	200mg/3ml	50	
CEC20153	CUC20153	500mg/3ml	50	
CEC20156	CUC20156	500mg/6ml	50	
CEC2011Z	CUC2011Z	100mg/10ml	50	
CEC2012Z	CUC2012Z	200mg/10ml	50	
CEC2015Z	CUC2015Z	500mg/10ml	50	
CEC201M6	CUC201M6	1g/6ml	30	
CEC2012M15	CUC2012M15	2g/15ml	20	
CEC2015M25	CUC2015M25	5g/25ml	20	
CEC20110M75	CUC20110M75	10g/75ml	10	

CYCLOHEXYL

CECYH1L1	CUCYH1L1	50mg/1ml	100
CECYH111	CUCYH111	100mg/1ml	100
CECYH123	CUCYH123	200mg/3ml	50
CECYH153	CUCYH153	500mg/3ml	50
CECYH156	CUCYH156	500mg/6ml	50
CECYH11Z	CUCYH11Z	100mg/10ml	50
CECYH12Z	CUCYH12Z	200mg/10ml	50
CECYH15Z	CUCYH15Z	500mg/10ml	50
CECYH1M6	CUCYH1M6	1g/6ml	30
CECYH12M15	CUCYH12M15	2g/15ml	20
CECYH15M25	CUCYH15M25	5g/25ml	20
CECYH110M75	CUCYH110M75	10g/75ml	10

CLEAN-UP[®]

Hydrophobic Product Guide

PHENYL

part number		amount sorbent/ tube volume	units per pack
endcapped	unendcapped		
CEPHY1L1	CUPHY1L1	50mg/1ml	100
CEPHY111	CUPHY111	100mg/1ml	100
CEPHY123	CUPHY123	200mg/3ml	50
CEPHY153	CUPHY153	500mg/3ml	50
CEPHY156	CUPHY156	500mg/6ml	50
CEPHY11Z	CUPHY11Z	100mg/10ml	50
CEPHY12Z	CUPHY12Z	200mg/10ml	50
CEPHY15Z	CUPHY15Z	500mg/10ml	50
CEPHY1M6	CUPHY1M6	1g/6ml	30
CEPHY12M15	CUPHY12M15	2g/15ml	20
CEPHY15M25	CUPHY15M25	5g/25ml	20
CEPHY110M75	CUPHY110M75	10g/75ml	10

CLEAN-UP[®] Carbon

Carbon supports have been used to isolate extremely polar organic compounds. They work by a hydrophobic mechanism with a high surface area and ion exchange. These interaction can happen in a wide range of polar and non-polar solvents.

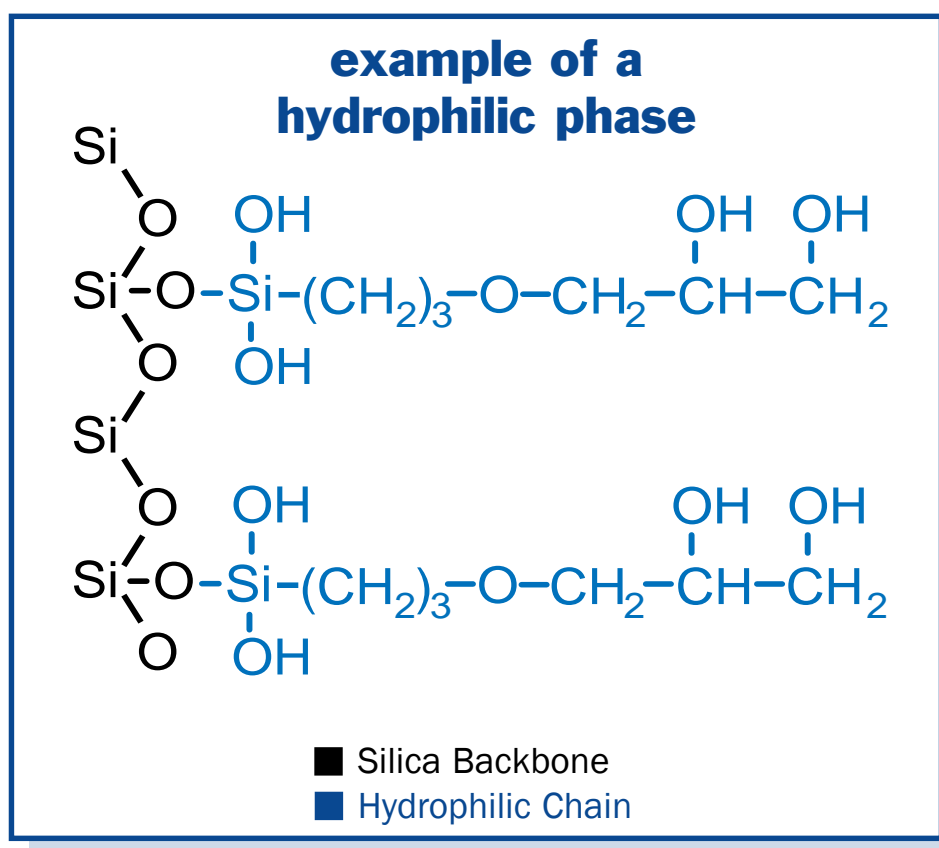
This sorbent is primarily used for environmental applications.

Carbon-Graphitized non-porous, 120/400 mesh

part number unencapped	amount sorbent/ tube volume	units per pack
CUCARBL1	50mg/1ml	100
CUCARB11	100mg/1ml	100
CUCARB1L3	150mg/3ml	50
CUCARB23	200mg/3ml	50
CUCARB2L3	250mg/3ml	50
CUCARB53	500mg/3ml	50
CUCARB2L6	250mg/6ml	30
CUCARB56	500mg/6ml	30
CUCARB1Z	100mg/10ml	50
CUCARB2Z	200mg/10ml	50
CUCARB5Z	500mg/10ml	30
CUCARBM6	1,000mg/6ml	20
CUCARBM15	1,000mg/15ml	20
CUCARB2M15	2,000mg/15ml	20
CUCARB5M25	5,000mg/25ml	20
CUCARB10M75	10,000mg/75ml	10

CLEAN-UP[®] Hydrophilic Extraction Columns

This sorbent is composed of a silica backbone bonded with carbon chains containing polar functional groups. Groups which will possess such polarity include amines, hydroxyls and carbonyls.



Analytes*	Washes	Elutions
R-OH, R-SH R-NH ₂ , R ₂ -NH, R ₃ -N	non-polar organic solvents ie: hexane/ethyl acetate (80:20) methylene chloride	polar organic solvent usually with some aqueous

*typical compounds which can be extracted using hydrophilic columns

Mechanism of Hydrophilic Bonding

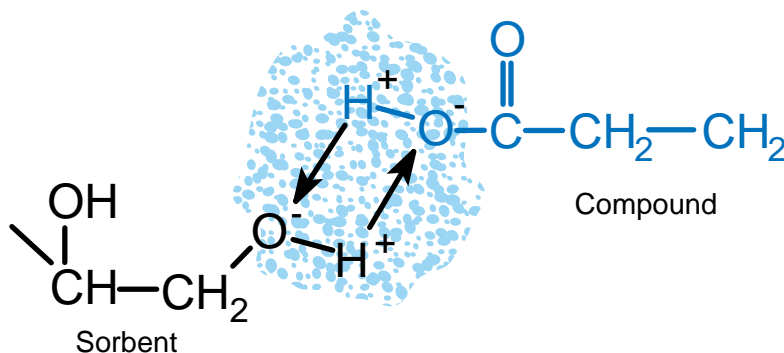
Compounds are retained on hydrophilic sorbents through polar interactions including hydrogen bonding, pi-pi or dipole-dipole interaction. These types of interactions occur when a distribution of electrons between individual atoms in functional groups is unequal, causing negative and positive polarity. Compounds typically extracted on a hydrophilic column include analytes which have polar groups, including amines, hydroxyls and carbonyls. Elution is performed by strong polar solvents.

Hydrophilic Sorbents & Structures

Sorbent	Structure
Silica	SiOH
Diol	Si(CH ₂) ₃ OCH ₂ CHOHCH ₂ OH
Cyanopropyl	Si(CH ₂) ₃ CN

NOTE: If un-ionized, ion exchange sorbents can be used as hydrophilic (polar) sorbents.

example of hydrophilic bonding



CLEAN-UP[®]

Hydrophilic Product Guide

Unbonded Silica

part number	amount sorbent/ tube volume	units per bag
CUSIL1L1	50mg/1ml	100
CUSIL111	100mg/1ml	100
CUSIL123	200mg/3ml	50
CUSIL153	500mg/3ml	50
CUSIL156	500mg/6ml	50
CUSIL11Z	100mg/10ml	50
CUSIL12Z	200mg/10ml	50
CUSIL15Z	500mg/10ml	50
CUSIL1M6	1g/6ml	30
CUSIL12M15	2g/15ml	20
CUSIL15M25	5g/25ml	20
CUSIL110M75	10g/75ml	10

Florisil[®] PR

CUFLS1L1	50 mg/1 ml	100
CUFLS111	100 mg/1ml	100
CUFLS123	200 mg/3 ml	50
CUFLS153	500 mg/3 ml	50
CUFLS156	500 mg/6 ml	50
CUFLS11Z	100 mg/10 ml	50
CUFLS12Z	200 mg/10 ml	50
CUFLS15Z	500 mg/10 ml	50
CUFLS1M6	1000 mg/6 ml	30
CUFLS12M15	2000 mg/15 ml	20
CUFLS15M25	5000 mg/25 ml	20
CUFLS110M75	10000 mg/75 ml	10

CLEAN-UP[®]

Hydrophilic Product Guide

Alumina Acid

part number	amount sorbent/ tube volume	units per bag
CUALA1L1	50 mg/1ml	100
CUALA111	100 mg/1 ml	100
CUALA123	200 mg/3 ml	50
CUALA153	500 mg/3 ml	50
CUALA156	500 mg/6 ml	50
CUALA11Z	100 mg/10 ml	50
CUALA12Z	200 mg/10 ml	50
CUALA15Z	500 mg/10 ml	50
CUALA1M6	1000 mg/6 ml	30
CUALA12M15	2000 mg/15 ml	20
CUALA15M25	5000 mg/25 ml	20
CUALA110M75	10000 mg/75 ml	10

Alumina Base

CUALB1L1	50 mg/1ml	100
CUALB111	100 mg/1 ml	100
CUALB123	200 mg/3 ml	50
CUALB153	500 mg/3 ml	50
CUALB156	500 mg/6 ml	50
CUALB11Z	100 mg/10 ml	50
CUALB12Z	200 mg/10 ml	50
CUALB15Z	500 mg/10 ml	50
CUALB1M6	1000 mg/6 ml	30
CUALB12M15	2000 mg/15 ml	20
CUALB15M25	5000 mg/25 ml	20
CUALB110M75	10000 mg/75 ml	10

CLEAN-UP[®]

Hydrophilic Product Guide

Alumina Neutral

part number	amount sorbent/ tube volume	units per bag
CUALN1L1	50 mg/1ml	100
CUALN111	100 mg/1 ml	100
CUALN123	200 mg/3 ml	50
CUALN153	500 mg/3 ml	50
CUALN156	500 mg/6 ml	50
CUALN11Z	100 mg/10 ml	50
CUALN12Z	200 mg/10 ml	50
CUALN15Z	500 mg/10 ml	50
CUALN1M6	1000 mg/6 ml	30
CUALN12M15	2000 mg/15 ml	20
CUALN15M25	5000 mg/25 ml	20
CUALN110M75	10000 mg/75 ml	10

Phenyl

part number		amount sorbent/ tube volume	units per bag
endcapped	unendcapped		
CEPHY1L1	CUPHY1L1	50 mg/1ml	100
CEPHY111	CUPHY111	100 mg/1 ml	100
CEPHY123	CUPHY123	200 mg/3 ml	50
CEPHY153	CUPHY153	500 mg/3 ml	50
CEPHY156	CUPHY156	500 mg/6 ml	50
CEPHY11Z	CUPHY11Z	100 mg/10 ml	50
CEPHY12Z	CUPHY12Z	200 mg/10 ml	50
CEPHY15Z	CUPHY15Z	500 mg/10 ml	50
CEPHY1M6	CUPHY1M6	1000 mg/6 ml	30
CEPHY12M15	CUPHY12M15	2000 mg/15 ml	20
CEPHY15M25	CUPHY15M25	5000 mg/25 ml	20
CEPHY110M75	CUPHY110M75	10000 mg/75 ml	10

CLEAN-UP[®]

Hydrophilic Product Guide

CN, Cyanopropyl

part number		amount sorbent/ tube volume	units per bag
endcapped	unendcapped		
CECNP1L1	CUCNP1L1	50 mg/1 ml	100
CECNP111	CUCNP111	100 mg/1 ml	100
CECNP123	CUCNP123	200 mg/3 ml	50
CECNP153	CUCNP153	500 mg/3 ml	50
CECNP156	CUCNP156	500 mg/6 ml	50
CECNP11Z	CUCNP11Z	100 mg/10 ml	50
CECNP12Z	CUCNP12Z	200 mg/10 ml	50
CECNP15Z	CUCNP15Z	500 mg/10 ml	50
CECNP1M6	CUCNP1M6	1000 mg/6ml	30
CECNP12M15	CUCNP12M15	2000 mg/15 ml	20
CECNP15M25	CUCNP15M25	5000 mg/25 ml	20
CECNP110M75	CUCNP110M75	10000 mg/75 ml	10

n-2 Aminoethyl

part number	amount sorbent/ tube volume	units per bag
CUPSA1L1	50 mg/1 ml	100
CUPSA111	100 mg/1 ml	100
CUPSA123	200 mg/3 ml	50
CUPSA153	500 mg/3 ml	50
CUPSA156	500 mg/6 ml	50
CUPSA11Z	100 mg/10 ml	50
CUPSA12Z	200 mg/10 ml	50
CUPSA15Z	500 mg/10 ml	50
CUPSA1M6	1000 mg/6ml	30
CUPSA12M15	2000 mg/15 ml	20
CUPSA15M25	5000 mg/25 ml	20
CUPSA110M75	10000 mg/75 ml	10

CLEAN-UP[®]

Hydrophilic Product Guide

Diol

part number	amount sorbent/ tube volume	units per bag
CUDOL1L1	50mg/1ml	100
CUDOL111	100mg/1ml	100
CUDOL123	200mg/3ml	50
CUDOL153	500mg/3ml	50
CUDOL156	500mg/6ml	50
CUDOL11Z	100mg/10ml	50
CUDOL12Z	200mg/10ml	50
CUDOL15Z	500mg/10ml	50
CUDOL1M6	1g/6ml	30
CUDOL12M15	2g/15ml	20
CUDOL15M25	5g/25ml	20
CUDOL110M75	10g/75ml	10

Cyanopropyl

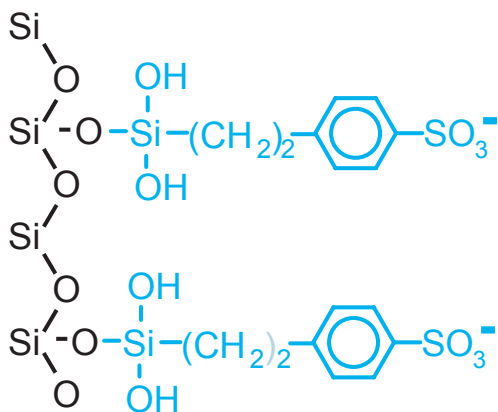
part number		amount sorbent/ tube volume	units per bag
endcapped	unendcapped		
CECNP111	CUCNP111	100mg/1ml	100
CECNP123	CUCNP123	200mg/3ml	50
CECNP153	CUCNP153	500mg/3ml	50
CECNP156	CUCNP156	500mg/6ml	50
CECNP11Z	CUCNP11Z	100mg/10ml	50
CECNP12Z	CUCNP12Z	200mg/10ml	50
CECNP15Z	CUCNP15Z	500mg/10ml	50
CECNP1M6	CUCNP1M6	1g/6ml	30
CECNP12M15	CUCNP12M15	2g/15ml	20
CECNP15M25	CUCNP15M25	5g/25ml	20
CECNP110M75	CUCNP110M75	10g/75ml	10

CLEAN-UP[®] Ion Exchange Extraction Columns

This sorbent is composed of a silica backbone bonded with a carbon chain terminated by a negatively or positively charged functional group.

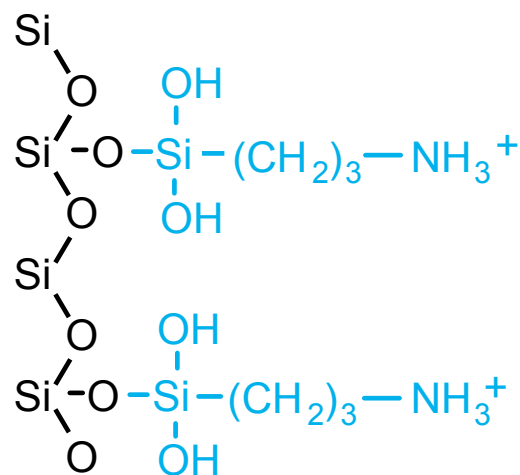
Ion exchange interactions occur between a sorbent that carries a charge and a compound of opposite charge.

example of a cation exchange phase



■ Silica Backbone
■ Cation exchanger

example of an anion exchange phase



■ Silica Backbone
■ Anion exchanger

This electrostatic interaction is reversible by neutralizing the sorbent and /or analyte. Ion exchange bonds can also be disrupted by introduction of a “counter ion” to compete with the analyte for binding sites on the sorbent.

Mechanism of Ion Exchange Bonding

Compounds are retained on the sorbent through ionic bonds. Therefore it is essential that the sorbent and the analyte to be extracted are charged. Generally, the number of molecules with charged cationic groups increases at pH values below the molecules pKa value. The number of molecules with charged anionic groups decreases at pH values below the molecule's pKa value. To ensure 99% or more ionization, the pH should be at least two pH units below the pKa of the cation and two pH units above the pKa of the anion. Elution occurs by using a solvent to raise the pH above the pKa of the cationic group or to lower the pH below the pKa of the anion to disrupt retention. At this point, the sorbent or compound will be neutralized.

Ion Exchange Sorbents & Structures

Sorbent	Structure	pKa
Anion Exchangers		
Aminopropyl (1°amine)	$\text{Si}(\text{CH}_2)_3\text{NH}_3^+$	9.8
n-2Aminoethyl (2°amine)	$\text{Si}(\text{CH}_2)_3\text{NH}_2^+(\text{CH}_2)_2\text{NH}_3^+$	10.1, 10.9
Diethylamino (3°amine)	$\text{Si}(\text{CH}_2)_3\text{NH}^+(\text{CH}_2\text{CH}_3)_2$	10.6
Quaternary Amine (4°amine)	$\text{Si}(\text{CH}_2)_3\text{N}^+(\text{CH}_3)_3$	always charged
Cation Exchangers		
Propylsulfonic Acid	$\text{Si}(\text{CH}_2)_3\text{SO}_3\text{H}$	<1
Benzenesulfonic Acid	$\text{Si}(\text{CH}_2)_2-\text{C}_6\text{H}_4-\text{SO}_3\text{H}$	always charged
Carboxylic Acid	SiCH_2COOH	4.8

NOTE: In an un-ionized state, these sorbents are hydrophilic (polar) sorbents.

Note: Neutralization can occur on either the sorbent or the analyte of interest. Either will disrupt the bond of the desired compound.

Analytes*

Anions
Cations

Washes

Organic solvent or aqueous buffer at pH that allows the ion to remain charged
AND/OR at a low ionic strength
AND/OR at a weak concentration

Elutions

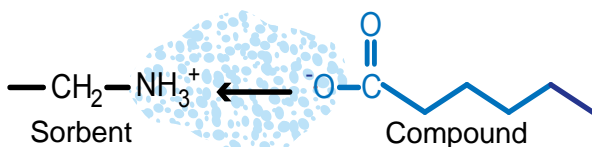
Organic solvent and aqueous buffer at pH that would neutralize the ion
AND/OR at a high ionic strength
AND/OR at a strong concentration

*typical compounds which can be extracted using ion exchange columns

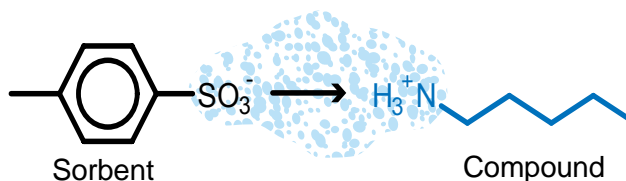
Anion Exchange Sorbent			Cation Exchange Sorbent		
	Goal	pH	Goal	pH	
WASH	To promote bonding between sorbent and analyte	> analyte pKa or < sorbent pKa	To promote bonding between sorbent and	< analyte pKa or > sorbent pKa	
Elution	To disrupt bonding between sorbent and analyte	< analyte pKa or > sorbent pKa	To disrupt bonding between sorbent and	> analyte pKa or < sorbent pKa	

Percent of Compound in Ionic State						
Functionality	Ionization	pH units away from pKa				
		2 < pKa	1 < pKa	at pKa	1 > pKa	2 > pKa
Acid	Anionic (-)	1	9	50	91	99
Base	Cationic (+)	99	91	50	9	1

example of anion exchange binding



example of cation exchange binding



CLEAN-UP[®]

Anion Exchange Product Guide

Aminopropyl

part number	amount sorbent/ tube volume	units per bag
CUNAX1L1	50mg/1ml	100
CUNAX111	100mg/1ml	100
CUNAX123	200mg/3ml	50
CUNAX153	500mg/3ml	50
CUNAX156	500mg/6ml	50
CUNAX11Z	100mg/10ml	50
CUNAX12Z	200mg/10ml	50
CUNAX15Z	500mg/10ml	50
CUNAX1M6	1g/6ml	30
CUNAX12M15	2g/15ml	20
CUNAX15M25	5g/25ml	20
CUNAX110M75	10g/75ml	10

Quaternary Amine

CUQAX1L1	50mg/1ml	100
CUQAX111	100mg/1ml	100
CUQAX123	200mg/3ml	50
CUQAX153	500mg/3ml	50
CUQAX156	500mg/6ml	50
CUQAX11Z	100mg/10ml	50
CUQAX12Z	200mg/10ml	50
CUQAX15Z	500mg/10ml	50
CUQAX1M6	1g/6ml	30
CUQAX12M15	2g/15ml	20
CUQAX15M25	5g/25ml	20
CUQAX110M75	10g/75ml	10

CLEAN-UP[®]

Anion Exchange Product Guide

Diethylamino

CUDAX1L1	50mg/1ml	100
CUDAX111	100mg/1ml	100
CUDAX123	200mg/3ml	50
CUDAX153	500mg/3ml	50
CUDAX156	500mg/6ml	50
CUDAX11Z	100mg/10ml	50
CUDAX12Z	200mg/10ml	50
CUDAX15Z	500mg/10ml	50
CUDAX1M6	1g/6ml	30
CUDAX12M15	2g/15ml	20
CUDAX15M25	5g/25ml	20
CUDAX110M75	10g/75ml	10

CLEAN-UP[®]

Cation Exchange Product Guide

Benzenesulfonic Acid

part number	amount sorbent/ tube volume	units per bag
CUBCX1L1	50mg/1ml	100
CUBCX111	100mg/1ml	100
CUBCX113	100mg/3ml	50
CUBCX123	200mg/3ml	50
CUBCX153	500mg/3ml	50
CUBCX156	500mg/6ml	50
CUBCX11Z	100mg/10ml	50
CUBCX12Z	200mg/10ml	50
CUBCX15Z	500mg/10ml	50
CUBCX1M3	1g/3ml	30
CUBCX1M6	1g/6ml	30
CUBCX12M6	2g/6ml	20
CUBCX12M15	2g/15ml	20
CUBCX15M25	5g/25ml	20
CUBCX110M75	10g/75ml	10

CLEAN-UP[®]

Cation Exchange Product Guide

Benzenesulfonic Acid - HIGH LOAD

part number	amount sorbent/ tube volume	units per bag
CUBCX1HL11	100mg/1ml	100
CUBCX1HL23	200mg/3ml	50
CUBCX1HL53	500mg/3ml	50
CUBCX1HL56	500mg/6ml	50
CUBCX1HL1Z	100mg/10ml	50
CUBCX1HL2Z	200mg/10ml	50
CUBCX1HL5Z	500mg/10ml	50
CUBCX1HLM6	1000g/6ml	30
CUBCX1HL2M15	2000g/15ml	20
CUBCX1HL2M6	2000g/6ml	20
CUBCX1HL5M25	5000g/25ml	20
CUBCX1HL10M25	10000g/25ml	20
CUBCX1HL5M75	5000g/75ml	20
CUBCX1HL10M75	10000g/75ml	20

Carboxylic Acid

CUCCX1L1	50mg/1ml	100
CUCCX111	100mg/1ml	100
CUCCX123	200mg/3ml	50
CUCCX153	500mg/3ml	50
CUCCX156	500mg/6ml	50
CUCCX11Z	100mg/10ml	50
CUCCX12Z	200mg/10ml	50
CUCCX15Z	500mg/10ml	50
CUCCX1M6	1g/6ml	30
CUCCX12M15	2g/15ml	20
CUCCX15M25	5g/25ml	20
CUCCX110M75	10g/75ml	10

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Anion Exchange Product Guide

Propylsulfonic Acid

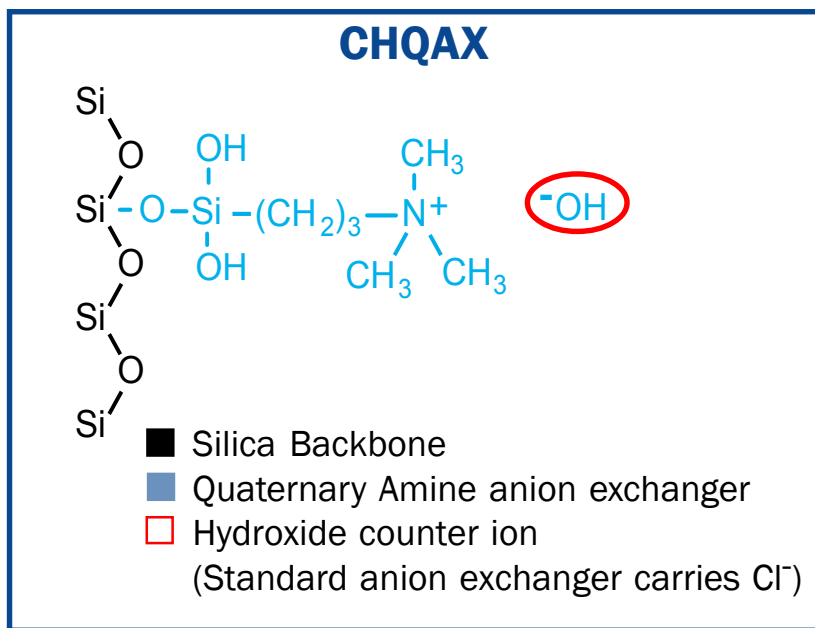
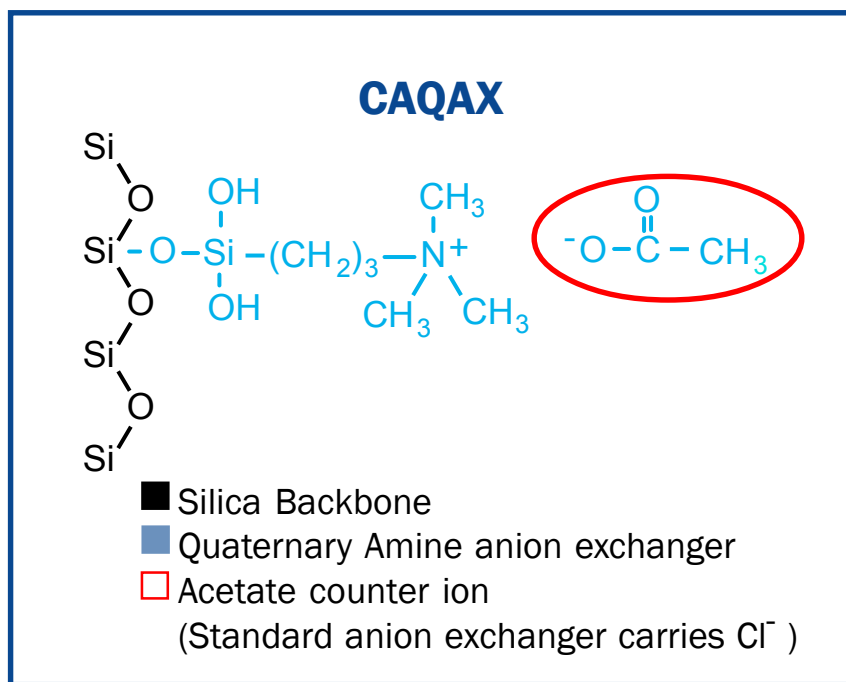
	amount sorbent/	
part number	tube volume	units per bag
CUPCX1L1	50mg/1ml	100
CUPCX111	100mg/1ml	100
CUPCX123	200mg/3ml	50
CUPCX153	500mg/3ml	50
CUPCX156	500mg/6ml	50
CUPCX11Z	100mg/10ml	50
CUPCX12Z	200mg/10ml	50
CUPCX15Z	500mg/10ml	50
CUPCX1M6	1g/6ml	30
CUPCX12M15	2g/15ml	20
CUPCX15M25	5g/25ml	20
CUPCX110M75	10g/75ml	10

CLEAN-UP[®]

Specialty Anion Exchange Columns

Ion exchange columns possess charged functional groups which allow analytes to bind upon sample application. Prior to column use, these groups require counter ions at these charged sites. The standard counter ion for cation exchangers is the hydronium ion and for anion exchangers is the chloride ion. From time to time during sample application, a charged analyte is not strong enough to displace the counter ion & therefore does not bind to the column.

In cases such as these, a weaker counter ion is required. We have introduced two such columns with



weaker counter ions-CAQAX (Quaternary amine with acetate counter ion) & CHQAX (Quaternary amine with hydroxide counter ion). In terms of strength, the acetate ion is stronger than the hydroxide ion.

Relative Counter ion Selectivity

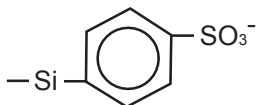
Larger numbers reflect greater ability of the ion to displace other ionic materials from the bonded surfaces.

Cations

Ba ²⁺	8.7
Ag ²⁺	7.6
Pb ²⁺	7.5
Hg ²⁺	7.2
Cu ⁺	5.3
Sr ²⁺	4.9
Ca ²⁺	3.9
Ni ²⁺	3.0
Cd ²⁺	2.9
Cu ²⁺	2.9
CO ²⁺	2.8
Zn ²⁺	2.7
Cs ²⁺	2.7
Rb ⁺	2.6
K ⁺	2.5
Fe ²⁺	2.5
Mg ²⁺	2.5
Mn ²⁺	2.3
NH ₄ ⁺	1.9
Na ⁺	1.5
H ⁺	1.0
Li ⁺	0.8

Standard cation exchange counter ion

Strong Cation Exchanger



Benzenesulfonic Acid (BCK)

Anions

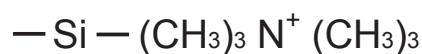
Benzene Sulfonate	500
Citrate	220
I ⁻	175
Phenate ⁻	110
HSO ₄ ⁻	85
ClO ₃ ⁻	74
NO ₃ ⁻	65
Br ⁻	50
CN ⁻	28
HSO ⁻	27
BrO	27
NO ₂	24
Cl ⁻	22
HCO ₃ ⁻	6.0
IO ₃ ⁻	5.5
Formate ⁻	4.6
Acetate ⁻	3.2
Propionate ⁻	2.6
F ⁻	1.6
OH ⁻	1.0

Standard anion exchange counter ion

Specialty anion exchange counter ion

Specialty anion exchange counter ion

Strong Anion Exchanger



Quaternary Amine (QAX)

CLEAN-UP[®]

Specialty Anion Exchange Columns

Quaternary Amine with Acetate counter ion

part number	amount sorbent/ tube volume	units per bag
CAQAX111	100mg/1ml	100
CAQAX123	200mg/1ml	50
CAQAX153	500mg/3ml	50
CAQAX156	500mg/6ml	50
CAQAX11Z	100mg/10ml	50
CAQAX12Z	200mg/10ml	50
CAQAX15Z	500mg/10ml	50
CAQAX1M6	1g/6ml	30
CAQAX12M6	2g/6ml	20
CAQAX12M15	2g/15ml	20
CAQAX15M25	5g/25ml	20
CAQAX110M75	10g/75ml	10

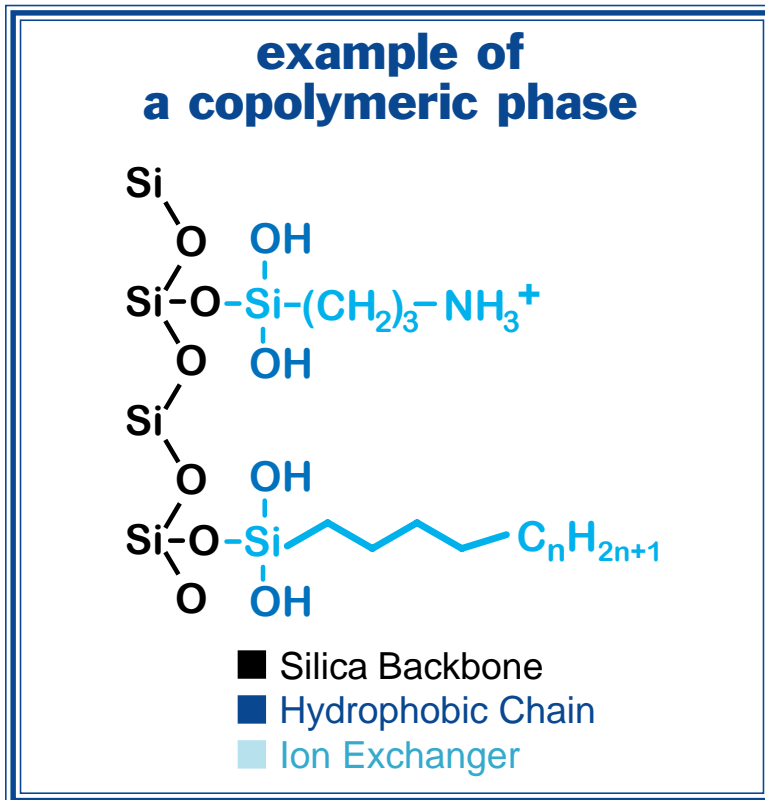
Quaternary Amine with Hydroxide counter ion

CHQAX111	100mg/1ml	100
CHQAX123	200mg/1ml	50
CHQAX153	500mg/3ml	50
CHQAX156	500mg/6ml	50
CHQAX11Z	100mg/10ml	50
CHQAX12Z	200mg/10ml	50
CHQAX15Z	500mg/10ml	50
CHQAX1M6	1g/6ml	30
CHQAX12M6	2g/6ml	20
CHQAX12M15	2g/15ml	20
CHQAX15M25	5g/25ml	20
CHQAX110M75	10g/75ml	10

CLEAN-UP[®]

Copolymeric Extraction Columns (Ion Exchange with Hydrophobic Character)


This sorbent is composed of a silica backbone with two types of functional chains attached - an ion exchanger or polar chain and a hydrophobic carbon chain. Our copolymeric phases are produced in a way to allow for equal parts of each functional group to attach to the silica backbone. This polymerization technique yields reproducible bonded-phases and unique copolymeric chemistries which allow the controlled use of mixed mode separation mechanisms. The advantage of this type of dual chemistry is beneficial especially when one is looking for both a neutral & charged compound. This is common when a neutral parent drug metabolizes & becomes a charged compound.



Analytes*	Washes	Elutions
Cations/Anions	1) aqueous to disrupt hydrophilic interactions	1) organic, possibly with some aqueous to elute hydrophobically bound analytes
Alkanes		2) aqueous buffer with a pH that would neutralize ionically bound analytes or an aqueous with high ionic strength or a solvent with a counter ion that would bind to sorbent.
Alkenes	2) methanol to disrupt residual hydrophobic and hydrophilic interferences	
Aromatics		

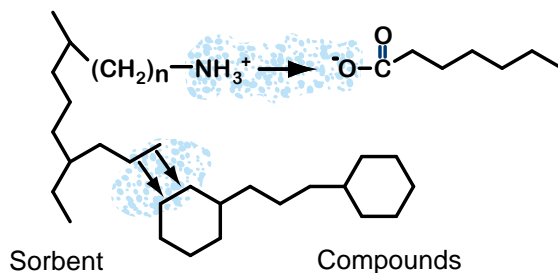
*Typical compounds which can be extracted using copolymeric columns.

Copolymeric Sorbents & Structures

Sorbent	Structure*	pKa
Benzenesulfonic Acid (BCX2) strong cation exchange column	$\text{Si}(\text{CH}_2)_2$  SO_3H	always charged
Propylsulfonic Acid (PCX2) strong cation exchange column	$\text{Si}(\text{CH}_2)_3 \text{SO}_3\text{H}$	< 1
Carboxylic Acid (CCX2) weak cation exchange column	$\text{Si}(\text{CH}_2)_2 \text{COOH}$	4.8
Quaternary amine (QAX2) strong anion exchange column	$\text{Si}(\text{CH}_2)_3 \text{N}^+(\text{CH}_3)_3$	always charged
Aminopropyl (NAX2) weak anion exchange column	$\text{Si}(\text{CH}_2)_3 \text{NH}_3^+$	9.8
Cyanopropyl (CNP2) hydrophilic exchange column	$\text{Si}(\text{CH}_2)_3 \text{CN}$	
Cyclohexyl (CYH2) hydrophobic exchange column	$\text{Si}(\text{CH}_2)$	

*Each copolymeric sorbent also contains a carbon chain approximately equal to a C8 chain

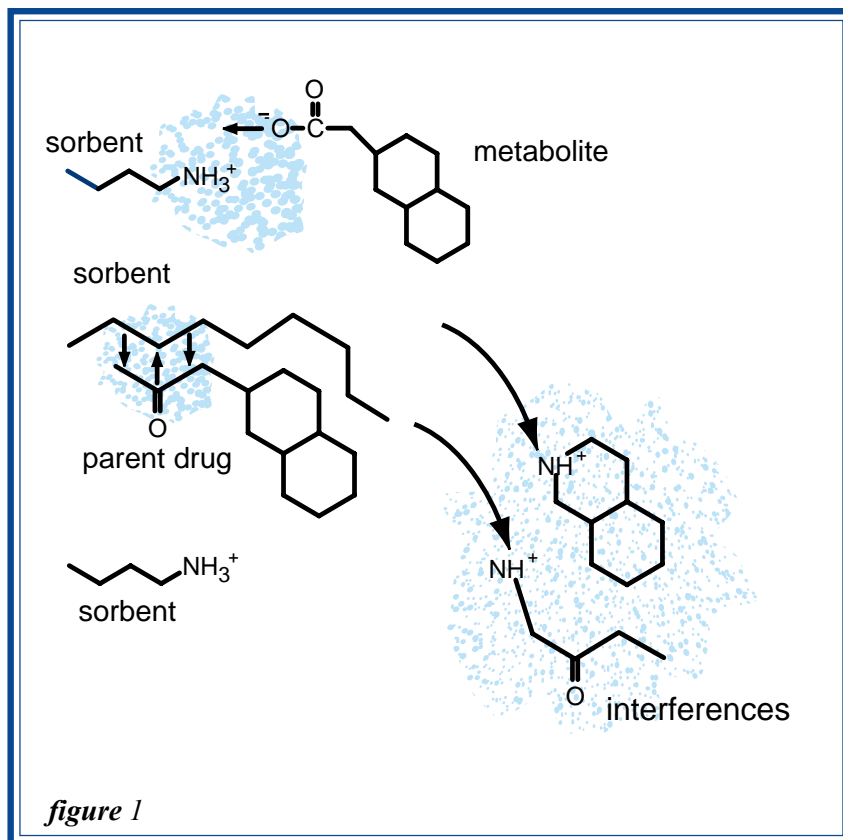
example of copolymeric bonding



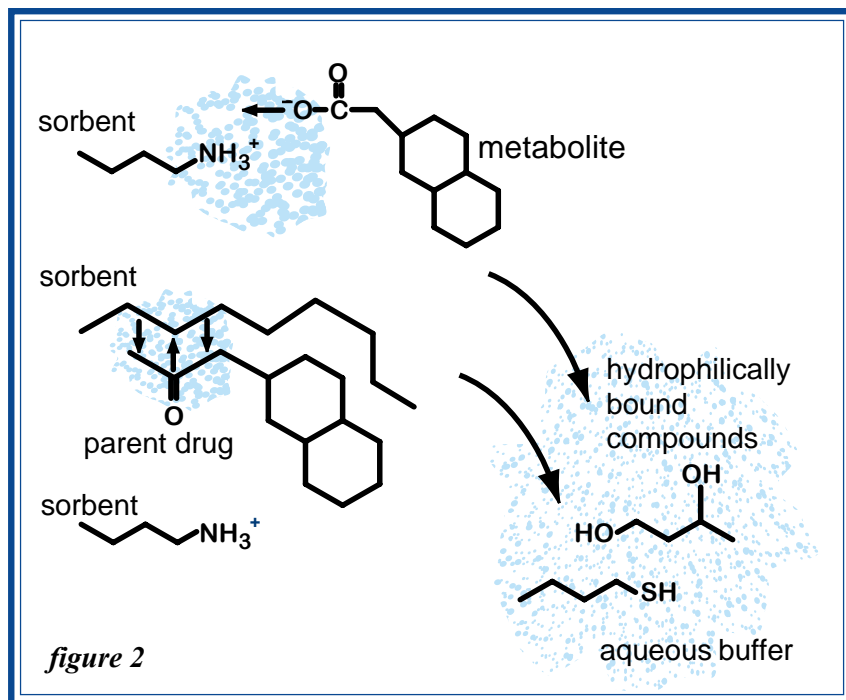
Sample Application

Mechanism of Copolymeric Bonding

Using a sample composed of a theoretical neutral parent drug and its charged (acidic) metabolite, it is applied at a pH of 6 (figure 1). At this pH, many amine groups are positively charged. Since the column is also positively charged, compounds with this chemistry (cations) are repelled. Depending on the pKa of the metabolite, carboxylic acid groups may be negatively charged, allowing the metabolite to bond to the positively charged sorbent. Since the column also possesses a hydrophobic chain, the neutral parent drug also bonds to the column.

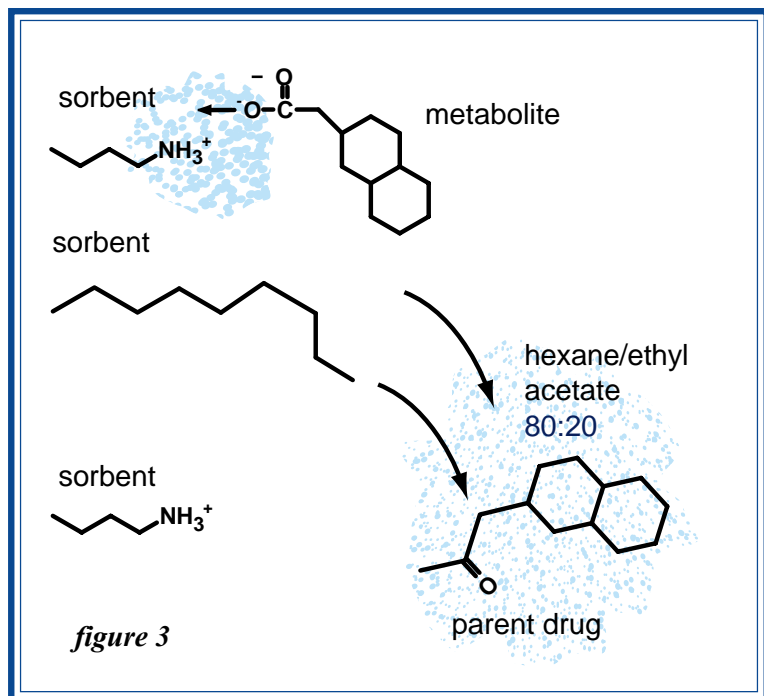


Column Wash



Water or a weak aqueous buffer (pH6) washes away hydrophilically bound interferences (figure 2). The column is then dried, careful to free the column of any residual aqueous phase that would interfere with elution.

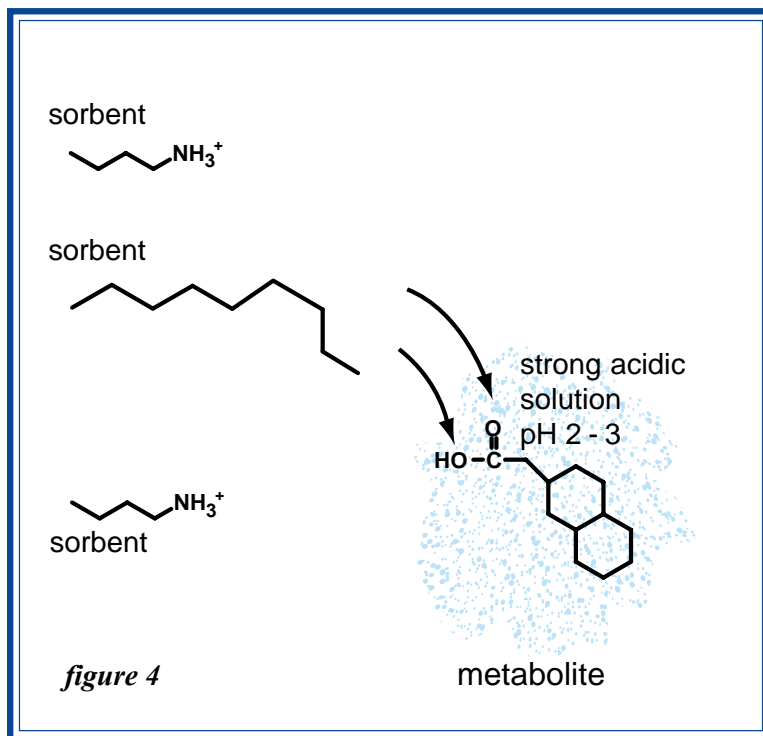
Elution 1



The hydrophobically bound neutral parent drug is eluted with a solvent of minimal polarity, such as hexane/ethyl acetate - 80:20 (figure 3).

Elution 2

The final elution employs an acid to neutralize the charge of acidic analytes. Ionic interaction is released, and analytes are eluted in an appropriate solvent mixture (figure 4).



CLEAN-UP[®]

Copolymeric Product Guide

Hydrophobic plus Cyclohexyl

part number	amount sorbent/ tube volume	units per bag
CUCYH2L1	50mg/1ml	100
CUCYH211	100mg/1ml	100
CUCYH223	200mg/3ml	50
CUCYH253	500mg/3ml	50
CUCYH256	500mg/6ml	50
CUCYH21Z	100mg/10ml	50
CUCYH22Z	200mg/10ml	50
CUCYH25Z	500mg/10ml	50
CUCYH2M6	1g/6ml	30
CUCYH22M15	2g/15ml	20
CUCYH25M25	5g/25ml	20
CUCYH210M75	10g/75ml	10

Hydrophobic plus Cyanopropyl

CUCNP2L1	50mg/1ml	100
CUCNP211	100mg/1ml	100
CUCNP223	200mg/3ml	50
CUCNP253	500mg/3ml	50
CUCNP256	500mg/6ml	50
CUCNP21Z	100mg/10ml	50
CUCNP22Z	200mg/10ml	50
CUCNP25Z	500mg/10ml	50
CUCNP2M6	1g/6ml	30
CUCNP22M15	2g/15ml	20
CUCNP25M25	5g/25ml	20
CUCNP210M75	10g/75ml	10

CLEAN-UP[®]

Copolymeric Product Guide

Hydrophobic plus Propylsulfonic Acid

part number	amount sorbent/ tube volume	units per bag
CUPCX2L1	50mg/1ml	100
CUPCX211	100mg/1ml	100
CUPCX223	200mg/3ml	50
CUPCX253	500mg/3ml	50
CUPCX256	500mg/6ml	50
CUPCX21Z	100mg/10ml	50
CUPCX22Z	200mg/10ml	50
CUPCX25Z	500mg/10ml	50
CUPCX2M6	1g/6ml	30
CUPCX22M15	2g/15ml	20
CUPCX25M25	5g/25ml	20
CUPCX210M75	10g/75ml	10

Hydrophobic plus Carboxylic Acid

CUCCX2L1	50mg/1ml	100
CUCCX211	100mg/1ml	100
CUCCX223	200mg/3ml	50
CUCCX253	500mg/3ml	50
CUCCX256	500mg/6ml	50
CUCCX21Z	100mg/10ml	50
CUCCX22Z	200mg/10ml	50
CUCCX25Z	500mg/10ml	50
CUCCX2M6	1g/6ml	30
CUCCX22M15	2g/15ml	20
CUCCX25M25	5g/25ml	20
CUCCX210M75	10g/75ml	10

CLEAN-UP[®]

Copolymeric Product Guide

Hydrophobic plus Benzenesulfonic Acid

part number	amount sorbent/ tube volume	units per bag
CUBCX2L1	50mg/1ml	100
CUBCX211	100mg/1ml	100
CUBCX223	200mg/3ml	50
CUBCX253	500mg/3ml	50
CUBCX256	500mg/6ml	50
CUBCX21Z	100mg/10ml	50
CUBCX22Z	200mg/10ml	50
CUBCX25Z	500mg/10ml	50
CUBCX2M6	1g/6ml	30
CUBCX22M15	2g/15ml	20
CUBCX25M25	5g/25ml	20
CUBCX210M75	10g/75ml	10

Hydrophobic plus Quaternary Amine

CUQAX2L1	50mg/1ml	100
CUQAX211	100mg/1ml	100
CUQAX223	200mg/3ml	50
CUQAX253	500mg/3ml	50
CUQAX256	500mg/6ml	50
CUQAX21Z	100mg/10ml	50
CUQAX22Z	200mg/10ml	50
CUQAX25Z	500mg/10ml	50
CUQAX2M6	1g/6ml	30
CUQAX22M15	2g/15ml	20
CUQAX25M25	5g/25ml	20
CUQAX210M75	10g/75ml	10

CLEAN-UP[®]

Copolymeric Product Guide

Hydrophobic plus Aminopropyl

part number	amount sorbent/ tube volume	units per bag
CUNAX2L1	50mg/1ml	100
CUNAX211	100mg/1ml	100
CUNAX223	200mg/3ml	50
CUNAX253	500mg/3ml	50
CUNAX256	500mg/6ml	50
CUNAX21Z	100mg/10ml	50
CUNAX22Z	200mg/10ml	50
CUNAX25Z	500mg/10ml	50
CUNAX2M6	1g/6ml	30
CUNAX22M15	2g/15ml	20
CUNAX25M25	5g/25ml	20
CUNAX210M75	10g/75ml	10