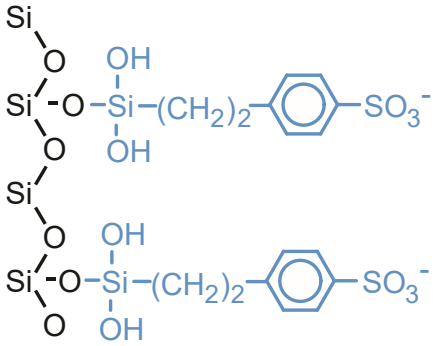
MECHANISM OF ION EXCHANGE BONDING

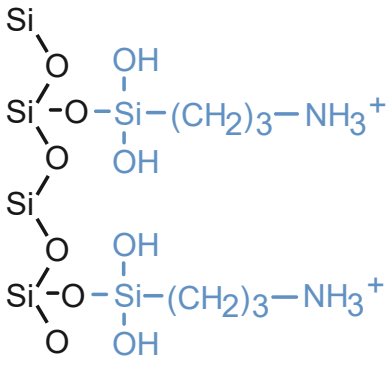
Compounds are retained on the sorbent through ionic bonds. Therefore, it is essential that the sorbent and the analyte to be extracted are charged. Generally, the number of molecules with charged cationic groups increases at pH values below the molecules pKa value. The number of molecules with charged 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 is neutralized.

Example of a Cation Exchange Phase



This sorbent is composed of a silica backbone bonded with carbon chains 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 Anion Exchange Phase



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

ION EXCHANGE SORBENTS & STRUCTURES

Sorbent	Structure	pKa
Anion Exchangers		
Aminopropyl (1° amine)	$-Si-(CH_2)_3NH_3^+$	9.8
N-2 Aminoethyl (1° & 2° amine)	$-Si-(CH_2)_3NH_2^+(CH_2)_2NH_3^+$	10.1, 10.9
Diethylamino (3° amine)	$-Si-(CH_2)_3NH^+(CH_2CH_3)_2$	10.6
Quaternary Amine Chloride	$-Si-(CH_2)_3N^+(CH_3)_3$ Cl^-	Always charged
Quaternary Amine Hydroxide	$-Si-(CH_2)3N^+(CH_3)_3$ OH	Always charged
Quaternary Amine Acetate	$-Si-(CH_2)_3N^+(CH_3)_3$ CH_3COO	Always charged
Quaternary Amine Formate	$-Si-(CH_2)_3N^+(CH_3)_3$ HCOO	Always charged
Polyimine	$-Si-(CH_2)_3-R^-$ $[NHCH_3CH_3]_x$	
Cation Exchangers		
Carboxylic Acid	$-Si-CH_2COOH$	
Propylsulfonic Acid	$-Si-(CH_2)_3SO_3H$	<1
Benzenesulfonic Acid	$-Si-(CH_2)_2$  SO_3H	Always charged
Benzenesulfonic Acid High Load	$-Si-(CH_2)_2$  SO_3H	Always charged
Triacetic Acid	$-Si-(CH_2)_3NH-(CH_2)_2N(CH_2COOH)_2$ CH_2COOH	

	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	< 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	> 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

CLEAN-UP®
BENZENESULFONIC ACID SORBENT

Organic Loading = 10.69%
Surface Area = 500 m^2/g
Pore Volume = 0.77 cm^3/g

Average Pore Size = 60Å
Cation Exchange = 0.320 meq/g

COLUMNS

Tube Volume (mL)	Sorbent Amount (mg)	Units per Pack	Part Number
1	50	100	CUBCX1L1
1	100	100	CUBCX111
3	200	50	CUBCX123
3	500	50	CUBCX153
6	100	50	CUBCX116
6	500	50	CUBCX156
6	1000	30	CUBCX1M6
10	100	50	CUBCX11Z
10	200	50	CUBCX12Z
10	500	50	CUBCX15Z
15	1000	30	CUBCX1M15
15	2000	30	CUBCX12M15
75	10000	10	CUBCX110M75

WELL PLATES

Number of Wells	Sorbent Amount (mg)	Units per Pack	Extended Drip Tip	Part Number
48	100	1	NO	WIMBCX11
96	50	1	NO	WSHBCX105

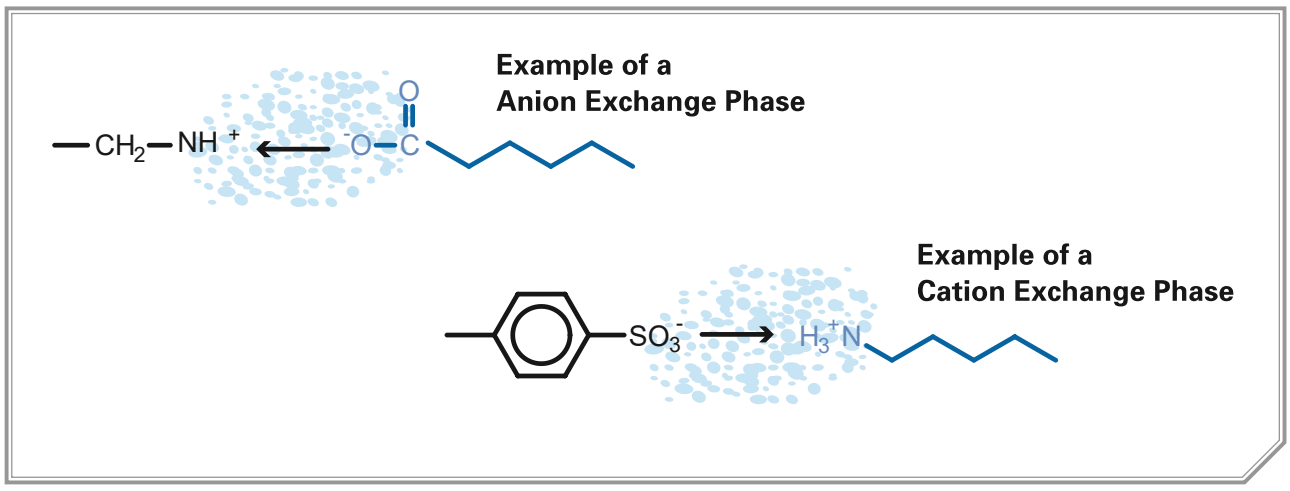
CLEAN-UP®
BENZENESULFONIC ACID HIGH LOAD SORBENT

Organic Loading = 16.50%
Surface Area = 500 m^2/g
Pore Volume = 0.77 cm^3/g

Average Pore Size = 60Å
Cation Exchange = 0.650 meq/g

COLUMNS

Tube Volume (mL)	Sorbent Amount (mg)	Units per Pack	Part Number
1	100	100	CUBCX1HL11
3	200	50	CUBCX1HL23
3	500	50	CUBCX1HL53
6	150	50	CUBCX1HL(150)06
6	500	50	CUBCX1HL56
6	1000	50	CUBCX1HL1M6
10	100	50	CUBCX1HL1Z
10	200	50	CUBCX1HL2Z
15	2000	20	CUBCX1HL2M15
75	10000	10	CUBCX1HL10M75



CLEAN-UP®
CATION EXTRACTION SORBENTS

CLEAN-UP®
CARBOXYLIC ACID SORBENT

Organic Loading = 8.75%
Surface Area = 500 m^2/g
Pore Volume = 0.77 cm^3/g

Average Pore Size = 60Å
Cation Exchange = 0.043 meq/g

COLUMNS			
Tube Volume (mL)	Sorbent Amount (mg)	Units per Pack	Part Number
1	50	100	CUCCX1L1
1	100	100	CUCCX111
3	200	50	CUCCX123
3	500	50	CUCCX153
6	500	50	CUCCX156
6	1000	30	CUCCX1M6
10	100	50	CUCCX11Z
10	200	50	CUCCX12Z
15	2000	20	CUCCX12M15
25	5000	20	CUCCX15M25

WELL PLATES				
Number of Wells	Sorbent Amount (mg)	Units per Pack	Extended Drip Tip	Part Number
48	100	1	NO	WIMCCX11
48	300	1	NO	WIMCCX13
96	50	1	NO	WSHCCX105
96	100	1	NO	WSHCCX11
96	100	1	YES	WSHCCX11-LD

CLEAN-UP®
PROPYLSULFONIC ACID SORBENT

Organic Loading = 7.00%
Surface Area = 500 m^2/g
Pore Volume = 0.77 cm^3/g

Average Pore Size = 60Å
Cation Exchange = 0.180 meq/g

COLUMNS			
Tube Volume (mL)	Sorbent Amount (mg)	Units per Pack	Part Number
1	100	100	CUPCX111
3	200	50	CUPCX123
3	500	50	CUPCX153
6	500	50	CUPCX156
6	1000	30	CUPCX1M6
10	100	50	CUPCX11Z
10	200	50	CUPCX12Z

CLEAN-UP®
TRIACETIC ACID SORBENT

Organic Loading = 7.50%
Surface Area = 500 m^2/g
Pore Volume = 0.77 cm^3/g

Average Pore Size = 60Å
Cation Exchange = 0.10 meq/g
Anion Exchange = 0.15 meq/g

COLUMNS			
Tube Volume (mL)	Sorbent Amount (mg)	Units per Pack	Part Number
1	100	100	CUTAX111
3	200	50	CUTAX123
3	500	50	CUTAX153
6	300	50	CUTAX136
6	500	50	CUTAX156
6	1000	30	CUTAX1M6
10	200	50	CUTAX12Z
75	10000	10	CUTAX110M75

P. 800.385.3153 | 215.781.9255 | **F.** 215.785.1226