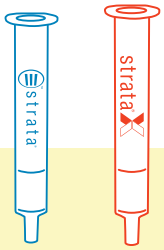
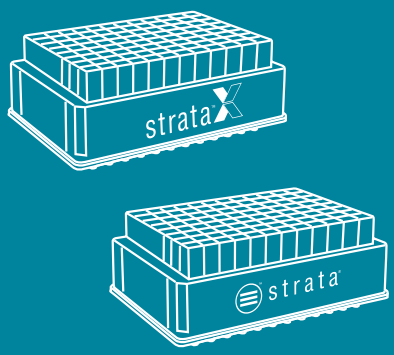


The Complete Guide
to Solid Phase Extraction (SPE)

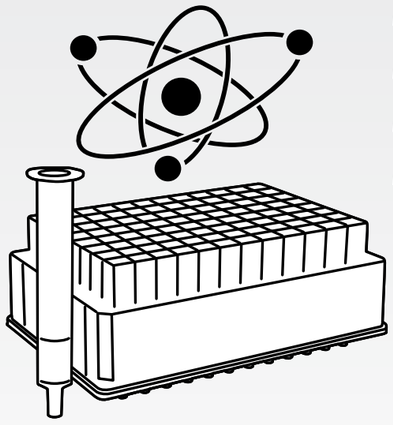
A method development and application guide



phenomenex®
...breaking with tradition℠

Solid Phase Extraction (SPE)

Solid Phase Extraction (SPE) is a very targeted form of sample preparation that allows you to isolate your analyte of interest while removing any interfering compounds that may be in your sample.



- Ultra clean extracts
- Concentration of samples for better chromatographic results
- Solvent switching for GC or LC compatibility
- Longer column lifetime and improved chromatographic results

www.phenomenex.com/SPE

guarantee

If Strata®-X or Strata SPE products do not perform as well or better than your current SPE product of similar phase, mass and size, return the product with comparative data within 45 days for a FULL REFUND.

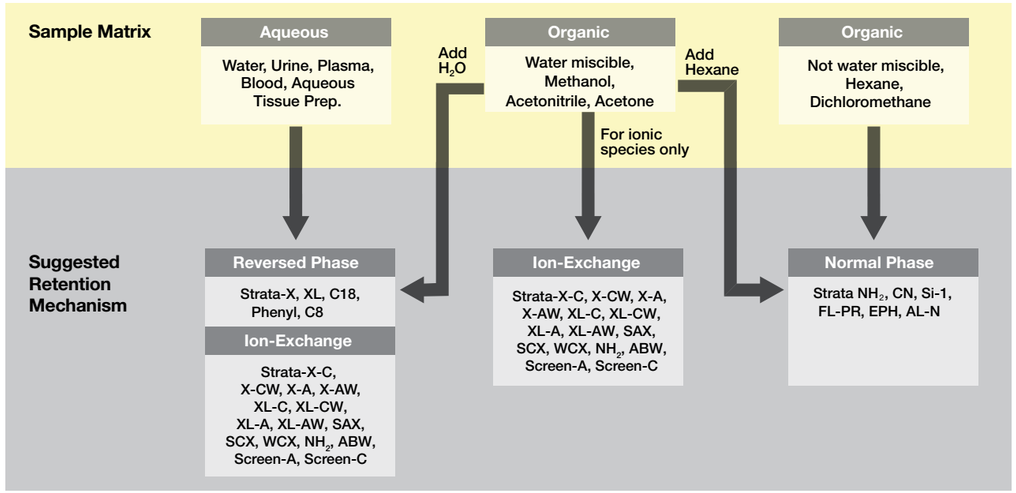
Getting Started

Follow 3 easy steps and start implementing your complete SPE method.

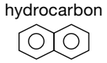
Step 1 Select a Sorbent

Selecting The Right Sorbent: Strata® Silica-Based and Strata-X Polymer-Based Sorbents

Identify the SPE Retention Mechanism



Determine the Sorbent Chemistry

SPE Mechanism	Analyte Functional Group	Sorbent Functional Group	Strata-X Sorbent	Strata Sorbent
Reversed Phase	R hydrocarbon  aromatic	R hydrocarbon  aromatic	X, XL	C18-E, C18-U, C8 C18-T Phenyl, SDBL
Normal Phase	R - OH hydroxyl R - NH_2 amino	CN polar OH polar		CN, NH_2 Si-1, CN, EPH
Ion-Exchange	NR_4^+ strong RNH_3^+ weak RSO_3^- strong RCO_2^- weak	$-O_2C$—weak $-O_3S$—strong ^+H_3N—weak ^+R_3N—strong	X-CW, XL-CW X-C X-AW, XL-AW X-A, XL-A	WCX Screen-C, SCX NH_2 Screen-A, SAX

Strata-X

Continue to Page 5

Strata

Continue to Page 6

Step 1a Strata®-X Polymeric SPE

Sorbert Properties

Table 1a. SPE Overview

	Strata-X	Strata
Increase Detection Sensitivity by removing matrix contaminants	•	•
Increase Column Lifetime by removing matrix contaminants	•	•
Quality Guaranteed by more than 20 QA and QC measures	•	•
Increase Reproducibility with robust methods	•	•
Save Time by processing multiple samples simultaneously or automating method	•	•
Specific Selectivity for your target analytes	•	•
Decreased Solvent Consumption with the highest loadability	•	
Decreased Blow-down Time with smaller elution volumes	•	
Decreased Sample Variation with deconditioning resistant sorbent	•	
pH Stable from 1-14	•	

Table 2a. Select Your Particle and Pore Size

	Strata-X, X-C, X-A, X-CW, X-AW	Strata-XL, XL-C, XL-A, XL-CW, XL-AW
Particle & Pore Size	33 µm, 85 Å	100 µm, 300 Å
High Concentration Samples	•	
Small Target Analytes (< 10 kDa)	•	
Large Target Analytes (> 10 kDa)		•
Large Volume Samples		•
Viscous Samples		•

Table 3a. Polymer-Based Sorbents Loading Capacities

Sample Matrix	Sorbent Mass	Strata-X, X-C, X-CW, X-A, X-AW	Strata-XL, XL-C, XL-CW, XL-A, XL-AW
Blood, serum, plasma	30 mg	250 µL	125 µL
Urine	30 mg	1 mL	500 µL
Filtered tissue homogenates	60 mg	100 mg	50 mg
Environmental Samples	**Sorbent Mass**	**Strata-X, X-C, X-CW, X-A, X-AW**	**Strata-XL, XL-C, XL-CW, XL-A, XL-AW**
Water (particulate-free) drinking	200 mg	100 - 400 mL	50 - 200 mL
Water (particulate-laden) rivers, runoff, etc.	500 mg	100 - 400 mL	50 - 200 mL
Soil extracts	500 mg	100 g	50 g

Table 4a. Sorbent Wash and Elution Volumes*

The volume of solvent needed for the wash and elution steps is directly related to the mass of sorbent in the SPE tube and more specifically the "bed volume" of the SPE device. Typically 4 – 16 bed volumes are used in SPE methods.

strata X Sorbent Mass	10 mg	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	1 g	2 g	5 g	10 g
Practical Minimum Wash and Elution Volume 4 bed volumes	100 µL	300 µL	600 µL	1 mL	1.5 mL	2 mL	5 mL	10 mL	20 mL	50 mL	100 mL
Recommended Wash and Elution Volume 8 bed volumes	200 µL	600 µL	1.2 mL	2 mL	3 mL	4 mL	10 mL	20 mL	40 mL	100 mL	200 mL

*The elution volumes are specific to the chemical nature of the analyte being extracted, its concentration in the sample, the chemical nature of the eluting solvent and the bed mass used. The above is a guideline. An elution study should be conducted to determine the appropriate volume to use.

Strata-X

Continue to Page 7

Step 1b Strata® Silica-Based SPE

Sorbent Properties

Table 1b. SPE Overview

	Strata	Strata-X
Increase Detection Sensitivity by removing matrix contaminants	•	•
Increase Column Lifetime by removing matrix contaminants	•	•
Quality Guaranteed by more than 20 QA and QC measures	•	•
Increase Reproducibility with robust methods	•	•
Save Time by processing multiple samples simultaneously or automating method	•	•
Specific Selectivity for your target analytes	•	•
Decreased Solvent Consumption with the highest loadability		•
Decreased Blow-down Time with smaller elution volumes		•
Decreased Sample Variation with deconditioning resistant sorbent		•
pH Stable from 1-14		•

Table 2b. Silica-Based Sorbents Loading Capacities

Sample Matrix	Sorbent Mass
Blood, serum, plasma	50 mg sorbent per 250 µL
Urine	50 mg sorbent per 500 µL
Filtered tissue homogenates	100 mg sorbent per 100 mg tissue
Environmental Samples	**Sorbent Mass**
Water (particulate-free) drinking	500 mg/100 mL - 500 mL sample
Water (particulate-laden) rivers, runoff, etc.	1 g/100 mL - 500 mL sample
Soil extracts	1 g/100 g of soil extract

Table 3b. Sorbent Wash and Elution Volumes*

The volume of solvent needed for the wash and elution steps is directly related to the mass of sorbent in the SPE tube and more specifically the "bed volume" of the SPE device. Typically 4 – 16 bed volumes are used in SPE methods.

strata Sorbent Mass	10 mg	50 mg	100 mg	150 mg	200 mg	500 mg	1 g	2 g	5 g	10 g
Practical Minimum Wash and Elution Volume 4 bed volumes	60 µL	300 µL	600 µL	900 µL	1.2 mL	3 mL	6 mL	12 mL	30 mL	60 mL
Recommended Wash and Elution Volume 8 bed volumes	120 µL	600 µL	1.2 mL	1.8 mL	2.4 mL	6 mL	12 mL	24 mL	60 mL	120 mL

*The elution volumes are specific to the chemical nature of the analyte being extracted, its concentration in the sample, the chemical nature of the eluting solvent and the bed mass used. The above is a guideline. An elution study should be conducted to determine the appropriate volume to use.

Strata → Continue to Page 7

Step 2 Sample Pre-treatment

Reproducible, high efficiency solid phase extraction requires that the sample be made liquid prior to loading onto a SPE device. The SPE sample should meet the following conditions:

- Liquid of low viscosity (to pass through the cartridge)
- Low solids or particulate contaminants (to prevent clogging)
- Solvent composition that is suitable for retention (each mechanism has different matrix solvent composition requirements for proper retention)

Biological Samples (liquid)	
Urine, Whole blood, Serum, Plasma, Bile, etc.	Dilute sample 1:2 with appropriate buffer, precipitate proteins if proteinaceous ($ZnSO_4$, ACN), hydrolyze urinary glucuronides, disruption of protein binding (sonication, enzymatic, acids/bases).
Biological Samples (solid)	
Organ tissues, Feces, GI contents	Homogenize with organic or aqueous solvent depending upon analyte solubility. Settle, decant, centrifuge or filter supernatant. Perform direct Matrix Solid Phase Dispersion (MSPD) extraction on tissue.
Sample Matrix	
Water (waste, river, etc.)	Buffer to appropriate pH and filter particulates from sample.
Soil, Sludge	Homogenize with organic or aqueous solvent depending upon analyte solubility. Settle, decant and filter supernatant; perform Soxhlet extraction.
Ointments, Creams	Oil-based Dissolve in non-polar organic (hexane) and extract via polar SPE. Water-based Dissolve in water or water miscible organic (methanol) and extract via non-polar SPE.
Fruit, Vegetable, Herbs	Homogenize with organic or aqueous solvent depending upon analyte solubility and filter supernatant. Use appropriate SPE mechanism for the dissolution solvent (hexane = polar mechanism; aqueous = non-polar mechanism; methanol/ACN = either non-polar or polar after proper dilution).

Strata-X → Continue to Page 8
Strata → Continue to Page 12

Sample Preparation Support at Your Fingertips

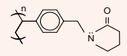
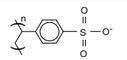
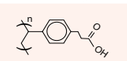
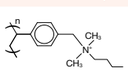
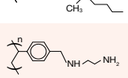
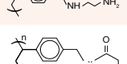
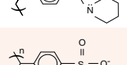
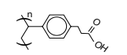
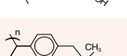
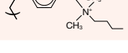
Dedicated sample preparation team available to assist your method development needs

Support@Phenomenex.com

Step 3a General Starting Methods: Strata®-X

Strata-X Polymeric SPE Phase Overview

- Clean extracts from biological sample matrices
- Streamlined method development and simple processing

Strata-X Phase	Functional Group	Mode	Analyte	Recommended Alternative to Waters®
Strata-X		Reversed Phase	Polar and Non-Polar	Oasis® HLB
Strata-X-C		Reversed Phase and Strong Cation-Exchange	Bases	Oasis MCX
Strata-X-CW		Reversed Phase and Weak Cation-Exchange	Bases (including Quaternary Amines)	Oasis WCX
Strata-X-A		Reversed Phase and Strong Anion-Exchange	Acids	Oasis MAX
Strata-X-AW		Reversed Phase and Weak Anion-Exchange	Acids (including Sulfonic acids)	Oasis WAX
Strata-XL		Large Particle Reversed Phase	Polar and Non-Polar	Oasis HLB
Strata-XL-C		Large Particle Reversed Phase and Strong Cation-Exchange	Bases	Oasis MCX
Strata-XL-CW		Large Particle Reversed Phase and Weak Cation-Exchange	Bases (including Quaternary Amines)	Oasis WCX
Strata-XL-A		Large Particle Reversed Phase and Strong Anion-Exchange	Acids	Oasis MAX
Strata-XL-AW		Large Particle Reversed Phase and Weak Anion-Exchange	Acids (including Sulfonic acids)	Oasis WAX

SPE Method Development Tool

Develop SPE methods for sample cleanup and concentration in under one minute.
www.phenomenex.com/mdtool

Step 3a General Starting Methods: Strata®-X (cont'd)

strataX Polymeric SPE

Strata-X / Strata-XL Reversed Phase

For Neutral Compounds

Condition
1 mL Methanol

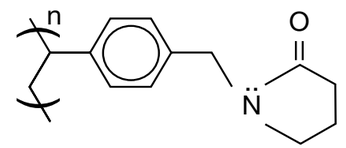
Equilibrate
1 mL Water

Load
Diluted Sample

Wash
1 mL 5-60 % Methanol

Elute
2x 500 µL 2 % Formic Acid in Methanol/Acetonitrile

Reversed Phase



Search Hundreds of Applications

Know the name of your analyte? Immediately find key Sample Prep applications for small molecules and biomolecules by entering the name or the chemical properties of the analyte.
www.phenomenex.com/applications

*Based on 30 mg/1 mL sorbent mass. The above is a convenient starting point for SPE method development. Further optimization may be required to tailor the method to your specific needs.

Step 3a General Starting Methods: Strata®-X (cont'd)

Strata-X-C / Strata-XL-C

Strong Cation-Exchange & Reversed Phase

For Bases with pK_a ≤ 10.5

Condition
1 mL Methanol

Equilibrate
1 mL Acidified Water

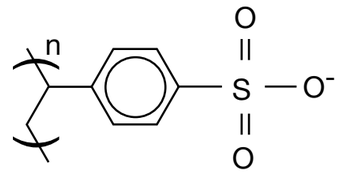
Load
Diluted Acidified Sample

Wash 1
1 mL 0.1 N HCl in Water
(collect this fraction to analyze Polar Neutrals)

Wash 2
1 mL 0.1 N HCl in Methanol
(collect this fraction to analyze Neutrals/Acids)

Elute Bases
2x 500 µL 5 % NH_4OH in Methanol

Strong Cation-Exchange: sulfonic acid ligand



Strata-X-CW / Strata-XL-CW

Weak Cation-Exchange & Reversed Phase

For Bases with pK_a > 8

Condition
1 mL Methanol

Equilibrate
1 mL Water, pH 6-7

Load
Diluted Sample, pH 6-7

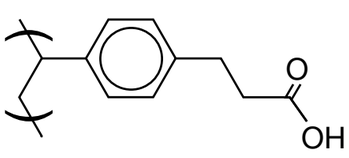
Wash 1
1 mL Water, pH 6-7

Wash 2
1 mL Methanol
(collect this fraction to analyze Neutrals/Acids)

Elute Any Base
2x 500 µL 5 % Formic Acid in Methanol

Elute Weak Bases
2x 500 µL 5 % NH_4OH in Methanol

Weak Cation-Exchange: carboxylic acid ligand



*Based on 30 mg/1 mL sorbent mass. The above is a convenient starting point for SPE method development. Further optimization may be required to tailor the method to your specific needs.

Step 3a General Starting Methods: Strata®-X (cont'd)

Strata-X-A / Strata-XL-A

Strong Anion-Exchange & Reversed Phase

For Acids with pK_a > 2

Condition
1 mL Methanol

Equilibrate
1 mL Water, pH 6-7

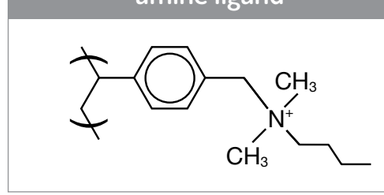
Load
Diluted Sample pH 6-7

Wash 1
1 mL 25 mM Ammonium Acetate Buffered, pH 6-7

Wash 2
1 mL Methanol
(collect this fraction to analyze Neutral/Bases)

Elute Acids
2x 500 µL 5 % Formic Acid in Methanol

Strong Anion-Exchange: di-methylbutyl quaternary amine ligand



Strata-X-AW / Strata-XL-AW

Weak Anion-Exchange & Reversed Phase

For Acids with pK_a ≤ 5

Condition
1 mL Methanol

Equilibrate
1 mL Water, pH 6-7

Load
Diluted Sample, pH 6-7

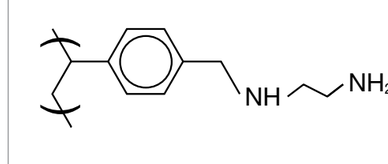
Wash 1
1 mL 25 mM Ammonium Acetate Buffered, pH 6-7

Wash 2
1 mL Methanol

Elute Any Acid
2x 500 µL 5 % NH_4OH in Methanol

Elute Weak Acids
2x 500 µL 5 % Formic Acid in Methanol

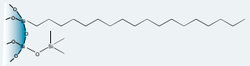
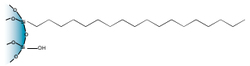
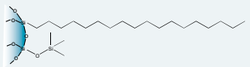
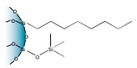
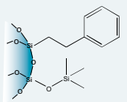
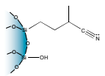
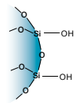
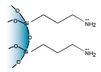
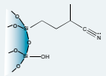
Weak Anion-Exchange: di-amino ligand



*Based on 30 mg/1 mL sorbent mass. The above is a convenient starting point for SPE method development. Further optimization may be required to tailor the method to your specific needs.

Strata Silica-Based SPE Phase Overview

strata Solid Phase Extraction

Reversed Phase Sorbents				Recommended Alternative to:				
Strata Phase	**Phase Benefits**	**Sorbent Chemistry**	**Recommended Method (See pp. 16-17)**	**Waters® Sep-Pak®**	**Agilent® SampliQ® Bond Elut®**	**Biotage® IST® ISOLUTE®**	**UCT® CleanScreen® StyreScreen®**	**Supelco® Discovery®**
C18-E	Extraction of hydrophobic molecules		METHOD 1	tC18	SampliQ C18EC Bond Elut C18	C18 (EC)	C18	DSC-18
C18-U	Enhanced cleanup of hydrophobic compounds that contain hydroxy or amine functional groups		METHOD 1		Bond Elut C18-OH	C18		
C18-T	Wide pore for the extraction of large hydrophobic molecules (up to 75 kDa)		METHOD 1	C18	Bond Elut C18-EWP			DSC-18Lt
C8	Extraction of extremely hydrophobic compounds that are retained too tightly on C18-E		METHOD 1	C8	SampliQ C8 Octyl Bond Elut C8	C8(EC)	C8	DSC-8
Phenyl (PH)	Extraction of aromatic compounds		METHOD 1		SampliQ Phenyl Bond Elut PH	PH	Phenyl	DSC-Ph
CN	Extraction of polar compounds		METHOD 1	CN	SampliQ Cyano (CN) Bond Elut Cyano (CN-E)	CN	CN	DSC-CN
SDB-L	Extraction of non-polar and polar compounds; pH resistant sorbent		METHOD 1		SampliQ DVB Bond Elut ENV Bond Elut LMS	101	StyreScreen® DVB	DSC-PS/DVB
Normal Phase Sorbents								
Si-1 (Silica)	Extraction of polar compounds that are similar in structure		METHOD 6	Silica	SampliQ Silica Bond Elut SI	SI	Silica	DSC-Si
FL-PR (Florisil®)	Extraction of pesticides	Florisil	METHOD 6	Florisil®	SampliQ Florisil® PR Bond Elut Florisil®	FL	Florisil® PR	ENVI-Florisil®
NH_2	Extraction of strong anions		METHOD 6	NH_2	SampliQ Amino (NH_2) Bond Elut Aminopropyl (NH_2)	NH_2	Amino Propyl	DSC-NH_2
CN	Extraction of polar compounds		METHOD 6	CN	SampliQ Cyano (CN) Bond Elut Cyano (CN-E)	CN	CN	DSC-CN

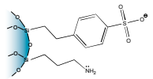
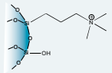
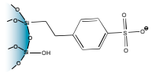
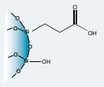
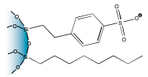
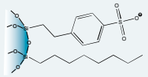
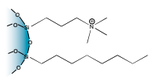
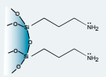
Step 3b General Starting Methods: Strata® (cont'd)

15

Step 3b General Starting Methods: Strata® (cont'd)

Strata Silica-Based Phase Overview

strata Solid Phase Extraction

Ion-Exchange Sorbents				Recommended Alternative to:				
Strata Phase	**Phase Benefits**	**Sorbent Chemistry**	**Recommended Method (See pp. 16-17)**	**Waters® Sep-Pak®**	**Agilent® SampliQ® Bond Elut®**	**Biotage® IST® ISOLUTE®**	**UCT® CleanScreen® StyreScreen®**	**Supelco® Discovery®**
ABW	Fractionation of neutral compounds such as amides from acidic and basic analytes		Inquire					
SAX	Extraction of weak anions		METHOD 5	Accell Plus QMA	SampliQ Si-SAX Bond Elut SAX	SAX	Quaternary Amine	DSC-SAX
SCX	Extraction of 1°, 2°, and 3° amines		METHOD 3		SampliQ Si-SCX Bond Elut SCX	SCX-3	Benzene Sulfonic Acid	DSC-SCX
WCX	Extraction of quaternary amines		METHOD 3	Accell Plus CM	Bond Elut CBA	CBA	Carboxylic Acid	DSC-WCX
Screen-C	Mixed-mode cation-exchange that also provides hydrophobic retention		METHOD 3		SampliQ C8/Si-SCX Mixed Mode Bond Elut Certify®	HCX	Clean Screen® DAU	
Screen-C GF	Large particle size, mixed-mode cation-exchange that also provides hydrophobic retention		METHOD 3		Bond Elut Certify® I HF		Xtract® DAU	
Screen-A	Mixed-mode anion-exchange that also provides hydrophobic retention		METHOD 5		Bond Elut Certify® II	HAX	Clean Screen THC	
NH_2	Extraction of strong anions		METHOD 4	NH_2	SampliQ Amino (NH_2) Bond Elut Aminopropyl (NH_2)	NH_2	Amino Propyl	DSC-NH_2
Special Sorbents								
Alumina-N (AL-N)	Extraction of polar compounds from food and environmental samples	Proprietary	METHOD 6	Alumina-N				
EPH (Extractable Petroleum Hydrocarbons)	Fractionation of aliphatic and aromatic hydrocarbons from environmental samples		METHOD 6					

Phenomenex | WEB: www.phenomenex.com

Step 3b General Starting Methods: Strata® (cont'd)

Strata

Reversed Phase — **METHOD 1**

- **Condition**
  1 mL Methanol
- **Equilibrate**
  1 mL DI Water
- **Load**
  Pretreated sample
- **Wash**
  1 mL 5 % Methanol in DI Water, dry under vacuum for 2-5 min
- **Elute**
  1 mL Methanol

Strata WCX

Weak Cation - Exchange — **METHOD 2**

- **Condition**
  1 mL Methanol
- **Equilibrate**
  1 mL DI Water, pH 6-7
- **Load**
  Pretreated sample, pH 6-7
- **Wash 1**
  1 mL Water, pH 6-7
- **Wash 2**
  1 mL Methanol, dry under vacuum for 2-5 min
- **Elute Any Base**
  1 mL 5 % Formic Acid in Methanol
- **Elute Weak Bases**
  1 mL 5 % NH_4OH in Methanol

Strata SCX

Strong Cation - Exchange — **METHOD 3**

- **Condition**
  1 mL Methanol
- **Equilibrate**
  1 mL Acidified Water
- **Load**
  Pretreated sample (acidified)
- **Wash 1**
  1 mL 0.1N HCl in Water
- **Wash 2**
  1 mL 0.1N HCl in Methanol, dry under vacuum for 2-5 min
- **Elute**
  1 mL 5 % NH_4OH in Methanol

*100 mg sorbent mass

Step 3b General Starting Methods: Strata® (cont'd)

strata Solid Phase Extraction

Strata NH_2

(WAX) Weak Anion - Exchange — **METHOD 4**

- **Condition**
  1 mL Methanol
- **Equilibrate**
  1 mL Water, pH 6-7
- **Load**
  Pretreated sample, pH 6-7
- **Wash 1**
  1 mL 25 mM Ammonium Acetate Buffer, pH 6-7
- **Wash 2**
  1 mL Methanol, dry under vacuum for 2-5 min
- **Elute Any Acid**
  1 mL 5 % NH_4OH in Methanol
- **Elute Weak Acids**
  1 mL 5 % Formic Acid in Methanol

Strata SAX

Strong Anion - Exchange — **METHOD 5**

- **Condition**
  1 mL Methanol
- **Equilibrate**
  1 mL Water
- **Load**
  Pretreated sample, pH 6-7
- **Wash 1**
  1 mL 25 mM Ammonium Acetate Buffer, pH 6-7
- **Wash 2**
  1 mL Methanol, dry under vacuum for 2-5 min
- **Elute**
  1 mL 5 % Formic Acid in Methanol

Strata

Strata Normal Phase Method — **METHOD 6**

- **Condition**
  IPA / DCM
- **Equilibrate**
  Hexane
- **Load**
  Pretreated sample
- **Wash**
  5 % DCM in Hexane
- **Elute**
  1:1 Hexane / DCM or 1:1 Hexane / IPA

*100 mg sorbent mass

Pharmaceutical: Preventing Analyte Loss

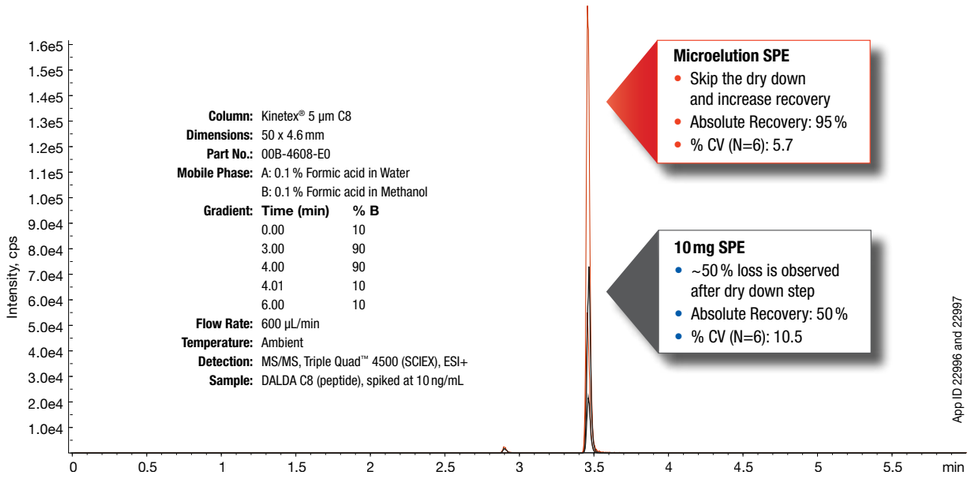
Preventing Analyte Loss by Skipping the Dry Down Step using Microelution SPE

Many target analytes, such as peptides and thermolabile compounds, can be lost during dry down steps. Stop risking analyte loss and skip the dry down, without losing sensitivity using Strata®-X microelution plates. A new format that provides increased sensitivity for analytes of interest.

SPE Protocol

	Strata-X 96-Well Plate, 10 mg/well	Strata-X Microelution 96-Well Plate, 2 mg/well
Part No.	8E-S100-AGB	8M-S100-4GA
Condition	400 µL Methanol	200 µL Methanol
Equilibrate	400 µL Water	200 µL Water
Load	400 µL diluted serum (200 µL serum diluted 1:1 with 4 % Phosphoric acid in water)	400 µL diluted serum (200 µL serum diluted 1:1 with 4 % Phosphoric acid in water)
Wash 1	400 µL 2 % Formic acid in water	200 µL 2 % Formic acid in water
Wash 2	400 µL 20 % Acetonitrile in water	200 µL 20 % Acetonitrile in water
Elute	2x 175 µL Trifluoroacetic acid/acetonitrile/water (1:74:25)	2x 25 µL Trifluoroacetic acid/acetonitrile/water (1:74:25)
Dry Down	Dry down under a gentle stream of Nitrogen and reconstitute in 50 µL Trifluoroacetic acid/ acetonitrile/water (1:74:25)	NOT REQUIRED
Inject	10 µL	10 µL

DALDA C8 (peptide) Extracted from Serum



Pharmaceutical: Compounds from Plasma

Improved Clean Up and Recovery of Pharmaceutical Compounds From Plasma: SPE vs. Liquid-Liquid Extraction

Although liquid-liquid extraction (LLE) has been frequently used in the past, newer techniques with improved specificity towards particular analytes have allowed analysts to improve recovery and reproducibility of their samples. It was found that SPE provides cleaner extracts, higher recoveries, and better reproducibility which can greatly improve results when working with pharmaceutical compounds from plasma.

SPE Protocol

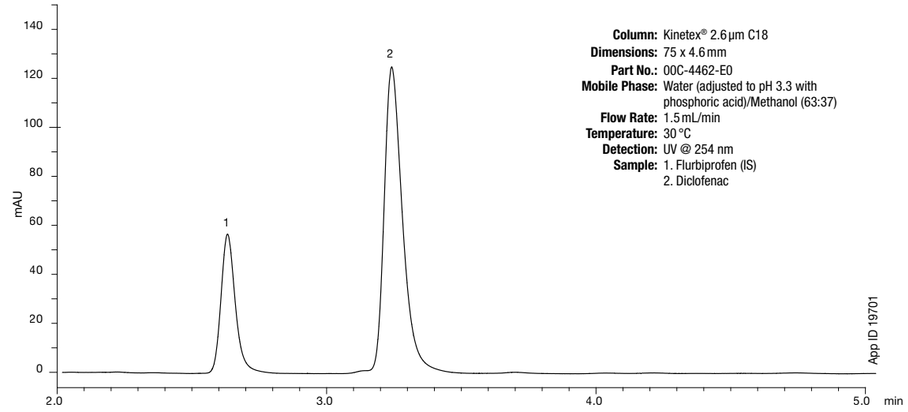
	Strata-X 30 mg/1 mL
Part No.	8B-S100-TAK
Condition	1 mL Methanol
Equilibrate	2 mL Water
Load	1.6 mL Pre-treated plasma
Wash	1 mL 5 % Methanol
Dry	1 minute under vacuum at 10 inches Hg
Elute	1 mL Methanol
Dry down	Dry down @ 53 °C under a stream of nitrogen for 20 minutes
Reconstitute	Reconstitute in 500 µL of mobile phase

% Absolute Recovery for Diclofenac

	Spiked Concentration	Diclofenac	Mean % RSD
SPE	15 µg/mL	86 % (n=4)	10
LLE	15 µg/mL	46 % (n=4)	35

Diclofenac spiked plasma sample (50 µg/mL) after extraction with Strata®-X. Flurbiprofen (IS) was added post-extraction at a concentration of 160 µg/mL. Note: the flurbiprofen was added post blow down, which is also post-extraction.

Chromatogram after SPE Extraction from a Plasma Matrix



To learn more about this method and others, visit:
www.phenomenex.com/SPE

Clinical Research: Amphetamines

Amphetamines from Urine Using Microelution SPE

An extraction method to isolate five amphetamines from urine using Strata®-X-C Microelution 96-well SPE plates followed by LC/MS/MS analysis. By utilizing the microelution SPE format, the dry down step was skipped saving at least 30 minutes without negatively impacting the sensitivity of our analysis. The five amphetamines were accurately quantified at detection levels down to 25 % below the cutoff levels specified by the Substance Abuse and Mental Health Services Administration (SAMHSA).

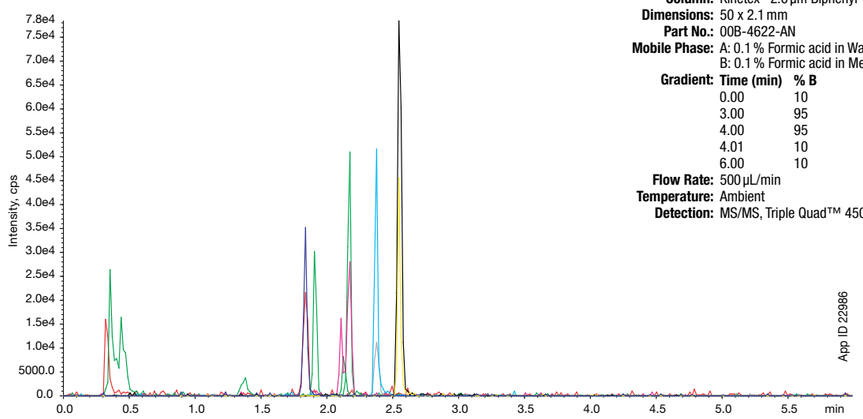
SPE Protocol

	Strata-X-C Microelution 96-Well Plate, 2 mg/well
Part No.	8M-S029-4GA
Condition	200 µL Methanol
Equilibrate	200 µL Water
Load	400 µL diluted urine (200 µL urine diluted 1:1 with water)
Wash 1	200 µL 2 % Formic acid in water
Wash 2	200 µL Methanol
Elute	2x 25 µL 5 % Ammonium hydroxide in acetonitrile/methanol (60:40)
Injection	2 µL

Amphetamines Extracted from Human Urine

Amphetamines	Concentration (ng/mL) (25 % below SAMHSA cut off)	RT (min)	% Absolute Recovery	% CV (N=8)
Amphetamine	125	1.83	82	13.1
Methamphetamine	125	2.12	107	15.1
MDA	62.25	2.15	106	4.2
MDMA	62.25	2.36	99	15.7
MDEA	62.25	2.53	108	10.5

Chromatogram of Amphetamines Extracted from Human Urine



Column: Kinetex® 2.6 µm Biphenyl
Dimensions: 50 x 2.1 mm
Part No.: 00B-4622-AN
Mobile Phase: A: 0.1 % Formic acid in Water
B: 0.1 % Formic acid in Methanol

Gradient:	**Time (min)**	**% B**
	0.00	10
	3.00	95
	4.00	95
	4.01	10
	6.00	10

Flow Rate: 500 µL/min
Temperature: Ambient
Detection: MS/MS, Triple Quad™ 4500 (SCIEX), ESI+

Clinical Research: Steriods

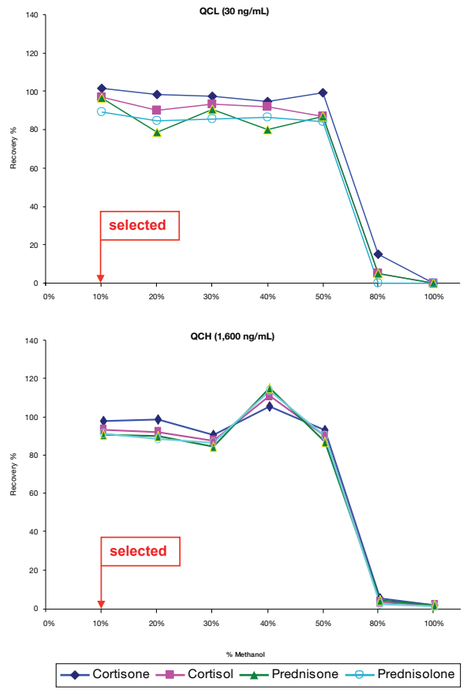
Urinary Steriods using Strata®-X SPE

We evaluated a variety of silica-based and polymer-based SPE sorbents for the quantification of cortisol, cortisone, prednisolone, and prednisone, each of which provides a different retention mechanism. The evaluation showed that the Strata-X polymer-based SPE sorbent, with a unique elution solvent has been found to be a robust, reproducible, and cost effective sample preparation solution for the laboratory in human urine for all four corticosteroids.

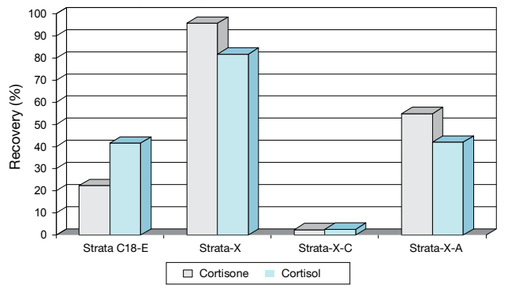
SPE Protocol

	Strata-X 96-Well Plate, 60 mg/well
Part No.	8E-S100-UGB
Condition	1 mL Methanol
Equilibrate	1 mL Water
Load	300 µL human urine diluted in 300 µL Water with 1 µg/mL IS (Cortisol D4)
Wash 1	1 mL Water
Wash 2	1 mL 10 % Methanol in Water
Elute	2x 500 µL of 2 % Formic Acid in Ethyl acetate/Isopropanol (85:15)
Dry Down	To dryness under a gentle Nitrogen stream at 50 °C
Reconstitute	100 µL of 10 mM Ammonium acetate/10 mM Ammonium acetate in Methanol (50:50)

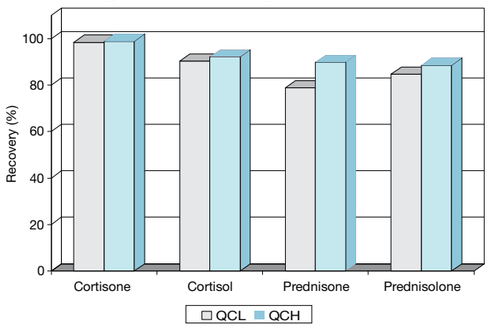
Wash Solvent Optimization



Recovery using SPE Sorbents



Recovery using Strata-X Across Low (QCL, 30 ng/mL) and High (QCH, 1600 ng/mL) QC Concentrations



Food: Chlorinated Pesticides

Chlorinated Pesticides in Poultry Tissue Using Strata® Alumina-N SPE

Animals used for food consumption are exposed to contaminants at levels that can pose harm to the human population. Presented is a method developed using Strata Alumina-N SPE and GC/ECD for pesticides analysis from poultry fat. This method improves upon the traditional procedure by reducing time and increasing accuracy and reliability.

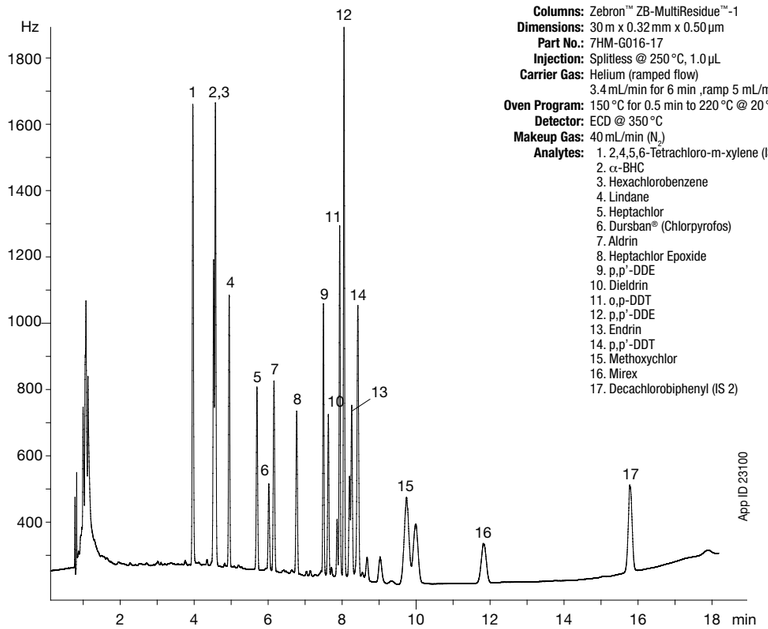
Pretreatment Protocol

1.	Using 1 minute intervals with a microwave, render poultry fat pads ensuring the sample does not exceed 100 °C
2.	Weigh 1 gram of rendered fat into a 10 mL volumetric flask and bring to volume with hexane containing internal standards 1 and 2
3.	Vortex or shake volumetric flasks to ensure proper mixing

SPE Protocol

	Strata Alumina-N, 2 g/12 mL
Part No.	8B-S313-KDG
Condition	Methanol/Water (86:14) at 10 mL/min until dry
Equilibrate	Petroleum ether at full cartridge volume at 10 mL/min
Load	1 mL Pretreated sample
Elute	Ethyl Ether/Petroleum Ether (1.5:98.5) at full cartridge volume and collect eluent
Dry Down	Dry down at ambient temperatures under a stream of nitrogen and evaporate to dryness
Reconstitute	2 mL Hexane

GC / EDC Analysis of Chlorinated Hydrocarbons



Columns: Zebron™ ZB-MultiResidue™-1
Dimensions: 30 m x 0.32 mm x 0.50 µm
Part No.: 7HM-G016-17
Injection: Splitless @ 250 °C, 1.0 µL
Carrier Gas: Helium (ramped flow)
3.4 mL/min for 6 min ,ramp 5 mL/min to 8 mL/min, hold 12.08 min
Oven Program: 150 °C for 0.5 min to 220 °C @ 20 °C/min to 310 °C @ 6 °C/min
Detector: ECD @ 350 °C
Makeup Gas: 40 mL/min (N_2)
Analytes:
1. 2,4,5,6-Tetrachloro-m-xylene (IS 1)
2. α-BHC
3. Hexachlorobenzene
4. Lindane
5. Heptachlor
6. Dursban® (Chlorpyrofos)
7. Aldrin
8. Heptachlor Epoxide
9. p,p'-DDE
10. Dieldrin
11. o,p-DDT
12. p,p'-DDE
13. Endrin
14. p,p'-DDT
15. Methoxychlor
16. Mirex
17. Decachlorobiphenyl (IS 2)

Food: Phenylbutazone

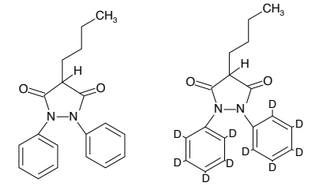
Phenylbutazone in Ground Meat using Strata®-X-A SPE

A simple yet effective SPE and cleanup method for phenylbutazone from meat with recovery values > 90 %. Highly specific LC/MS/MS data is generated using a Kinetex core-shell column enabling rapid run times under 5 minutes with excellent precision and accuracy.

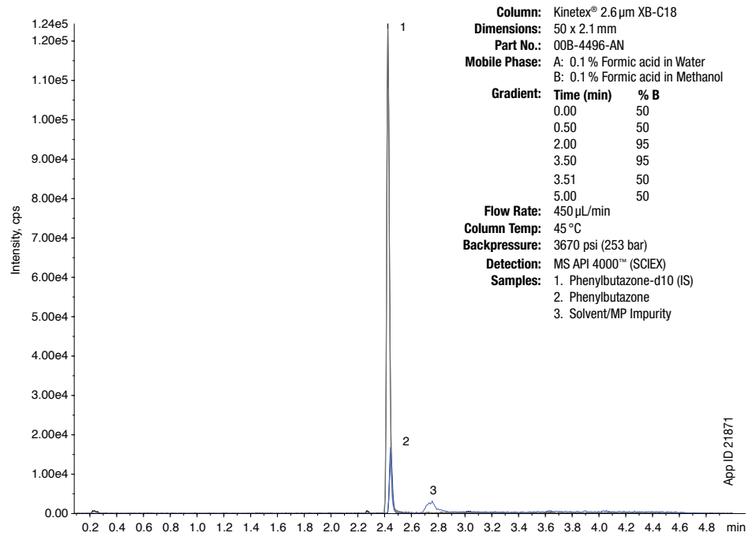
SPE Protocol

	Strata-X-A, 100 mg/6 mL
Part No.	8B-S123-ECH
Condition	3 mL Methanol
Equilibrate	3 mL DI Water
Load	4 mL of Pretreated sample
Wash 1	2 mL D.I. Water
Wash 2	2 mL Acetonitrile
Wash 3	2 mL Ethyl Acetate
Dry	5 minutes under full vacuum
Elute	2x 1.5 mL 1 % Formic Acid in Methanol
Dry Down	Evaporate under a stream of nitrogen gas at 50 °C to dryness
Reconstitute	Resuspend the residue with 500 µL of Methanol/ 0.1 % Formic Acid (50:50)

Phenylbutazone and Phenylbutazone-D10 Chemical Structures



Chromatogram of 10 ppb Phenylbutazone



Column: Kinetex® 2.6 µm XB-C18
Dimensions: 50 x 2.1 mm
Part No.: 00B-4496-AN
Mobile Phase: A: 0.1 % Formic acid in Water
B: 0.1 % Formic acid in Methanol
Gradient:

Time (min)	% B
0.00	50
0.50	50
2.00	95
3.50	95
3.51	50
5.00	50

Flow Rate: 450 µL/min
Column Temp: 45 °C
Backpressure: 3670 psi (253 bar)
Detection: MS API 4000™ (SCIEX)
Samples:
1. Phenylbutazone-d10 (IS)
2. Phenylbutazone
3. Solvent/MP Impurity

% Recovery of Phenylbutazone from Beef Extract at 5 ppb and 75 ppb (µg/kg) n=4

Spiked Conc.	%CV	Accuracy
5	8.02	100.7
75	5.0	90.3

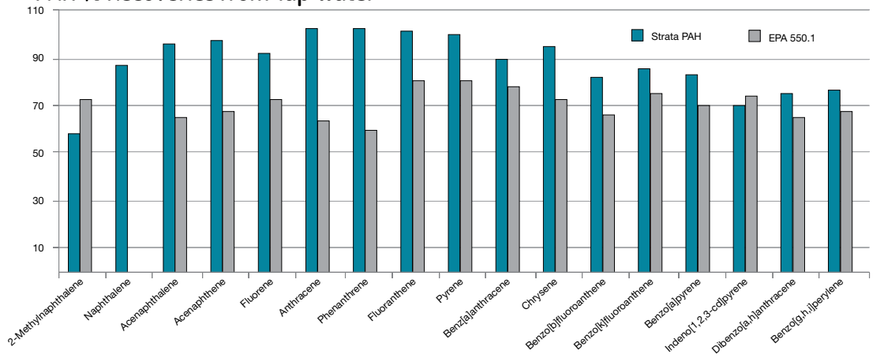
Polycyclic Aromatic Hydrocarbons using Strata® PAH as Compared to EPA Method 550.1

Polycyclic aromatic hydrocarbon compounds (PAHs) are effectively extracted from water samples while humic acids, which often interfere with chromatographic separation, are removed from the sample using a SPE sorbent, Strata PAH. It was also found that Strata PAH provides consistent, high recoveries of all 16 analytes listed under EPA Method 550.1.

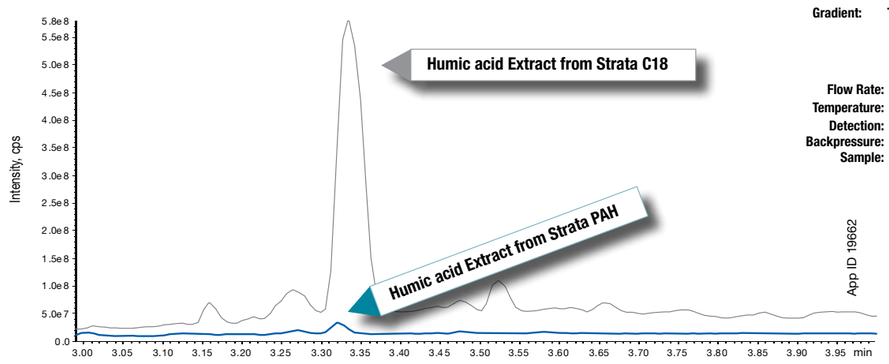
SPE Protocol

	Strata PAH, 1.5 g/6 mL
Part No.	8B-S130-7CH
Condition	20 mL Dichloromethane, 20 mL Methanol, 20 mL D.I. Water
Load	100 µL PAH standards (100 µg/mL in Acetonitrile) spiked into 100 mL Water/Acetonitrile (75:25)
Wash	5 mL Methanol/D.I. Water (50:50)
Dry	15 seconds under 10" Hg Vacuum
Elute	6 mL Dichloromethane

PAH % Recoveries from Tap Water



Effective Removal of Humic Acids



Column: Kinetex® 2.6 µm C8
Dimensions: 50 x 2.1 mm
Part No.: 00B-4497-AN
Mobile Phase: A: 5 mM Ammonium acetate
B: Methanol

Gradient: Time (min)	% B
0	15
2	95
6.0	95
6.01	15

Flow Rate: 0.4 mL/min
Temperature: Ambient
Detection: MS @ 580.4 amu / 536.5 amu (ambient)
Backpressure: 210 bar
Sample: Humic Acids from Suwannee River

Strata®-X Polymeric SPE Sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	**30 mg**	**60 mg**	**60 mg**	**200 mg**	**500 mg**	**100 mg**	**200 mg**	**500 mg**
Strata-X	8B-S100-TAK	8B-S100-UAK	8B-S100-UBJ	8B-S100-FBJ	8B-S100-HBJ	8B-S100-ECH	8B-S100-FCH	8B-S100-HCH
Strata-X-C	8B-S029-TAK	—	8B-S029-UBJ	8B-S029-FBJ	8B-S029-HBJ	8B-S029-ECH	8B-S029-FCH	8B-S029-HCH
Strata-X-CW	8B-S035-TAK	—	8B-S035-UBJ	8B-S035-FBJ	8B-S035-HBJ	8B-S035-ECH	8B-S035-FCH	8B-S035-HCH
Strata-X-A	8B-S123-TAK	—	8B-S123-UBJ	8B-S123-FBJ	8B-S123-HBJ	8B-S123-ECH	8B-S123-FCH	8B-S123-HCH
Strata-X-AW	8B-S038-TAK	—	8B-S038-UBJ	8B-S038-FBJ	8B-S038-HBJ	8B-S038-ECH	8B-S038-FCH	8B-S038-HCH
Strata-XL	8B-S043-TAK	—	8B-S043-UBJ	8B-S043-FBJ	8B-S043-HBJ	8B-S043-ECH	8B-S043-FCH	8B-S043-HCH
Strata-XL-C	8B-S044-TAK	—	8B-S044-UBJ	8B-S044-FBJ	8B-S044-HBJ	8B-S044-ECH	8B-S044-FCH	8B-S044-HCH
Strata-XL-CW	8B-S052-TAK	—	8B-S052-UBJ	8B-S052-FBJ	8B-S052-HBJ	8B-S052-ECH	8B-S052-FCH	8B-S052-HCH
Strata-XL-A	8B-S053-TAK	—	8B-S053-UBJ	8B-S053-FBJ	8B-S053-HBJ	8B-S053-ECH	8B-S053-FCH	8B-S053-HCH
Strata-XL-AW	8B-S051-TAK	—	8B-S051-UBJ	8B-S051-FBJ	8B-S051-HBJ	8B-S051-ECH	8B-S051-FCH	8B-S051-HCH

strata X Polymeric SPE

Strata® Silica-Based SPE Sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	**50 mg**	**100 mg**	**100 mg**	**200 mg**	**500 mg**	**200 mg**	**500 mg**	**1 g**
C18-E	8B-S001-DAK	8B-S001-EAK	8B-S001-EBJ	8B-S001-FBJ	8B-S001-HBJ	8B-S001-FCH	8B-S001-HCH	8B-S001-JCH
C18-U	—	8B-S002-EAK	—	8B-S002-FBJ	8B-S002-HBJ	—	8B-S002-HCH	8B-S002-JCH
C18-T	—	8B-S004-EAK	—	8B-S004-FBJ	8B-S004-HBJ	—	8B-S004-HCH	8B-S004-JCH
C8	—	8B-S005-EAK	—	8B-S005-FBJ	8B-S005-HBJ	—	8B-S005-HCH	8B-S005-JCH
Phenyl	—	8B-S006-EAK	—	8B-S006-FBJ	8B-S006-HBJ	—	8B-S006-HCH	8B-S006-JCH
SCX	—	8B-S010-EAK	8B-S010-EBJ	8B-S010-FBJ	8B-S010-HBJ	—	8B-S010-HCH	8B-S010-JCH
WCX	—	8B-S027-EAK	—	8B-S027-FBJ	8B-S027-HBJ	—	8B-S027-HCH	8B-S027-JCH
SAX	—	8B-S008-EAK	8B-S008-EBJ	8B-S008-FBJ	8B-S008-HBJ	—	8B-S008-HCH	8B-S008-JCH
NH2	—	8B-S009-EAK	—	8B-S009-FBJ	8B-S009-HBJ	—	8B-S009-HCH	8B-S009-JCH
CN	—	8B-S007-EAK	—	8B-S007-FBJ	8B-S007-HBJ	—	8B-S007-HCH	8B-S007-JCH
Si-1	—	8B-S012-EAK	—	8B-S012-FBJ	8B-S012-HBJ	—	8B-S012-HCH	8B-S012-JCH
Florisil®	—	—	—	—	8B-S013-HBJ	—	8B-S013-HCH	8B-S013-JCH
EPH	—	—	—	—	8B-S031-HBJ	—	—	—
AL-N	—	—	—	—	8B-S313-HBJ	—	—	8B-S313-JCH

strata Solid Phase Extraction

Strata Mixed-Mode Sorbents (for drugs of abuse)

Tubes	1 mL (100/box)	3 mL (50/box)			6 mL (30/box)		
Phase	**—**	**100 mg**	**100 mg**	**150 mg**	**200 mg**	**200 mg**	**500 mg**	**—**
Screen-C	—	8B-S016-EAK	8B-S016-EBJ	8B-S016-SBJ	8B-S016-FBJ	8B-S016-FCH	8B-S016-HCH	—
Screen-A	—	8B-S019-EAK	—	—	8B-S019-FBJ	8B-S019-FCH	8B-S019-HCH	—

Strata Polymeric Sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	**50 mg**	**100 mg**	**—**	**200 mg**	**500 mg**	**200 mg**	**500 mg**	**1 g**
SDB-L	8B-S014-DAK	8B-S014-EAK	—	8B-S014-FBJ	8B-S014-HBJ	8B-S014-FCH	8B-S014-HCH	8B-S014-JCH

Accessories For Tubes

Adapter Caps		
Part No.	**Description**	**Unit**
AH0-7191	Adapter Caps for 1, 3, and 6 mL SPE tubes, polyethylene, with Luer tip	15/pk

SPE Tube Vacuum Manifolds

Part No.	Description	Unit
24 - Position Vacuum Manifold*3		
AH0-6024	SPE 24-Position Vacuum Manifold Set, complete assembly	ea
12 - Position Vacuum Manifold*2		
AH0-6023	SPE 12-Position Vacuum Manifold Set, complete assembly	ea
10 - Position Tall-Boy™ Vacuum Manifold*1		
AH0-7502	SPE 10-Position Tall-Boy Vacuum Manifold, complete assembly	ea

*Manifolds include: Vacuum-tight glass chamber, vacuum gauge assembly, polypropylene lid with gasket, male and female luers and yellow end plugs, stopcock valves, collection rack assemblies, polypropylene needles, lid support legs. Waste container included with 12-position manifold.

(1) The 10-position Tall Boy Vacuum Manifold Collection Rack includes 4 plates: one base plate, one dimple plate, one small plate and one large plate and three riser bar legs, along with 12 manifold clips to support the plates. The assembly also includes 10 polypropylene needles, 10 stopcocks and 4 black legs to support the lid when taken off the glass block.

(2) The 12-position Collection Rack Assembly consists of 3 support legs, base plate, dimple plate, small plate, medium plate, large plate, volumetric plate, and 12 retaining clips.

(3) The 24-position Collection Rack Assembly consists of 3 support legs, base plate, dimple plate, small plate, large plate, and 12 retaining clips.

96-Well Plate Ordering Information

Strata®-X Polymeric SPE Sorbents

96-Well Plates (2/Box)			
Phase	10 mg	30 mg	60 mg
Strata-X-AW	8E-S038-AGB	8E-S038-TGB	8E-S038-UGB
Strata-X-A	8E-S123-AGB	8E-S123-TGB	8E-S123-UGB
Strata-X	8E-S100-AGB	8E-S100-TGB	8E-S100-UGB
Strata-X-C	8E-S029-AGB	8E-S029-TGB	8E-S029-UGB
Strata-X-CW	8E-S035-AGB	8E-S035-TGB	8E-S035-UGB
Strata-XL-AW	–	8E-S051-TGB	–
Strata-XL-A	–	8E-S053-TGB	–
Strata-XL	–	8E-S043-TGB	–
Strata-XL-C	–	8E-S044-TGB	–
Strata-XL-CW	–	8E-S052-TGB	–

Strata-X Microelution Plates

96-Well Plates (ea)	
Phase	2 mg
Strata-AW	8M-S038-4GA
Strata-A	8M-S123-4GA
Strata-X	8M-S100-4GA
Strata-X-C	8M-S029-4GA
Strata-X-CW	8M-S035-4GA

Strata Silica-Based SPE Sorbents

96-Well Plates (2/Box)			
Phase	25 mg	50 mg	100 mg
C18-E	8E-S001-CGB	8E-S001-DGB	8E-S001-EGB
C18-U	—	8E-S002-DGB	8E-S002-EGB
C18-T	8E-S004-CGB	8E-S004-DGB	—
C8	8E-S005-CGB	—	—
Phenyl	8E-S006-CGB	—	8E-S006-EGB
Silica	—	8E-S012-DGB	8E-S012-EGB
NH_2	8E-S009-CGB	8E-S009-DGB	8E-S009-EGB
SAX	8E-S008-CGB	8E-S008-DGB	8E-S008-EGB
SCX	8E-S010-CGB	8E-S010-DGB	8E-S010-EGB
WCX	8E-S027-CGB	8E-S027-DGB	—
Screen-C	—	8E-S016-DGB	8E-S016-EGB
SDB-L	—	8E-S014-DGB	—

96-Well Plate Vacuum Manifold

Part No.	Description	Unit
96-Well Plate Manifold**		
AH0-8950	96-Well Plate Manifold, Universal w/vacuum gauge	ea

**Manifold, compatible with 2 mL Impact plate, Strata and Strata-X 96-well plate formats.

guarantee

If Strata-X or Strata SPE products do not perform as well or better than your current SPE product of similar phase, mass and size, return the product with comparative data within 45 days for a FULL REFUND.

Presston 100 Manifold

96-Well Positive Pressure Manifold	
Part No.	Description
AH0-9334	Presston 100 Positive Pressure Manifold, 96-Well Plate
AH0-9342	Presston 100 Positive Pressure Manifold, 1 mL Tube Complete Assembly
AH0-9347	Presston 100 Positive Pressure Manifold, 3 mL Tube Complete Assembly
AH0-9343	Presston 100 Positive Pressure Manifold, 6 mL Tube Complete Assembly

The Presston 100 96-Well Positive Pressure Manifold can also process 1, 3, and 6 mL tubes using the following adapter kits.

Presston 100 Tube Adapter Kits

Tube Adapter Kits (for AH0-9334)	
Part No.	Description
AH0-9344	1 mL Tube Adapter Kit
AH0-9345	3 mL Tube Adapter Kit
AH0-9346	6 mL Tube Adapter Kit

WARRANTY

Phenomenex warrants that for a period of 12 months following delivery, the Presston 100 Positive Pressure Manifold you have purchased will perform in accordance with the published specifications and will be free from defects in materials or workmanship. In the event that the Presston 100 Positive Pressure Manifold does not meet this warranty, Phenomenex will repair or replace defective parts.

Please visit www.phenomenex.com/Presston for complete warranty information.

Tools and Resources

Kinetex Columns

2.6 µm Minibore Columns (mm)						SecurityGuard™ ULTRA Cartridges‡
Phases	30 x 2.1	50 x 2.1	75 x 2.1	100 x 2.1	150 x 2.1	3/pk
Biphenyl	00A-4622-AN	00B-4622-AN	––	00D-4622-AN	00F-4622-AN	AJ0-9209
XB-C18	00A-4496-AN	00B-4496-AN	00C-4496-AN	00D-4496-AN	00F-4496-AN	AJ0-8782
C8	00A-4497-AN	00B-4497-AN	00C-4497-AN	00D-4497-AN	00F-4497-AN	AJ0-8784
						for 2.1 mm ID

2.6 µm Analytical Columns (mm)						SecurityGuard™ ULTRA Cartridges‡
Phases	30 x 4.6	50 x 4.6	75 x 4.6	100 x 4.6	150 x 4.6	3/pk
C18	00A-4462-E0	00B-4462-E0	00C-4462-E0	00D-4462-E0	00F-4462-E0	AJ0-8788
						for 4.6 mm ID

5 µm Minibore Columns (mm)			SecurityGuard™ ULTRA Cartridges‡
Phases	50 x 2.1	100 x 2.1	3/pk
C8	00B-4608-AN	00D-4608-AN	AJ0-8784
			for 2.1 mm ID

5 µm Analytical Columns (mm)					SecurityGuard™ ULTRA Cartridges‡
Phases	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	3/pk
C8	00B-4608-E0	00D-4608-E0	00F-4608-E0	00G-4608-E0	AJ0-8770
					for 4.6 mm ID

‡SecurityGuard ULTRA Cartridges required holder, Part No.: AJ0-9000.

Zebron GC Columns

ZB-MultiResidue™ -1			
ID(mm)	df(µm)	Temp. Limits °C	Part No.
20-Meter			
0.18	0.18	-60 to 320/340	7FD-G016-08
30-Meter			
0.25	0.25	-60 to 320/340	7HG-G016-11
0.32	0.25	-60 to 320/340	7HM-G016-11
0.32	0.50	-60 to 320/340	7HM-G016-17
0.53	0.50	-60 to 320/340	7HK-G016-17

The Complete Guide to Solid Phase Extracton (SPE)

A Method Development and Application Guide

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