

Sample Cleanup: Method Development for Solid Phase Extraction and Beyond

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Solid Phase Extraction (SPE) – Why and How?

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Selecting the Right SPE – How?

- Analyte
- Sample matrix
- Sorbents and capacity
- SPE formats
- SPE processing

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Developing SPE Methods and Troubleshooting

- Nonpolar method

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What is New with SPE and Beyond?

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Summary

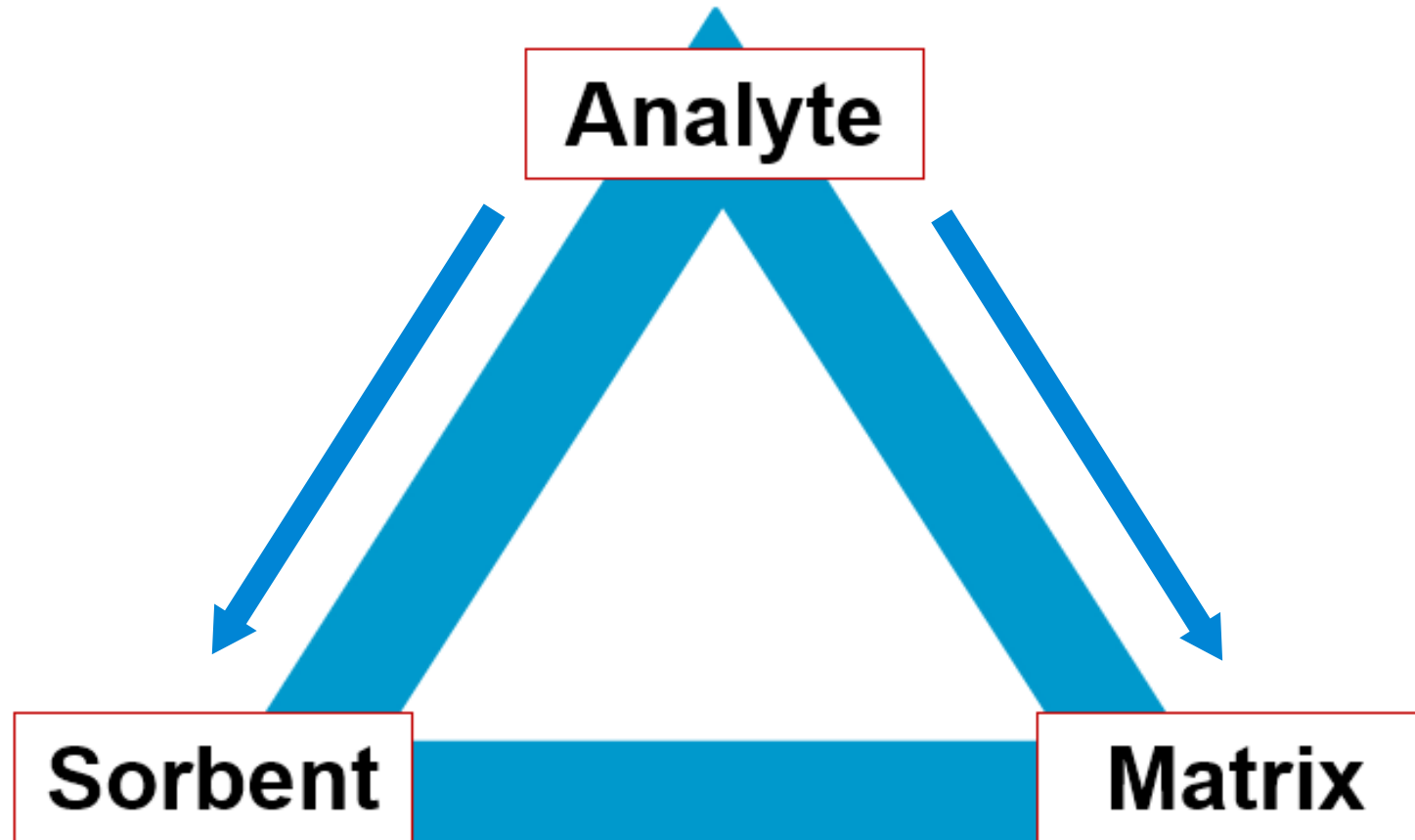
Solid Phase Extraction – Why and How?

Offline Options for Sample Matrix Removal

		← Instrument separation and detection specificity ←			← Less specific		
		→ Sample preparation specificity →			→ More specific		
Sample Preparation Technique	Interference Removed	Filtration	Supported Liquid Extractions (SLE)	Protein Precipitation and Filtration	QuEChERS	"Targeted Filtration" Protein Precipitation, Filtration, Lipid, and Matrix Removal	Solid Phase Extraction
Lipids	No	No	No	No	Yes	Yes	Yes
Oligomeric Surfactants	No	No	No	No	No	Yes	Yes
Particulates	Yes	Yes	Some	Yes	Yes	Yes	Yes
Pigments	No	No	Some	No	Yes	Yes	Yes
Polar Organic Acids	No	No	Yes	No	Yes	No	Yes
Proteins	No	No	Yes	Yes	Yes	Yes	Yes
Salts	No	No	Yes	No	No	No	Yes
Suggested Agilent Product	Captiva syringe filters Captiva filter vials		Chem Elut S	Captiva ND	Bond Elut QuEChERS with d-EMR-Lipid and other dispersive	Captiva EMR line	Bond Elut Silica and Polymeric SPE



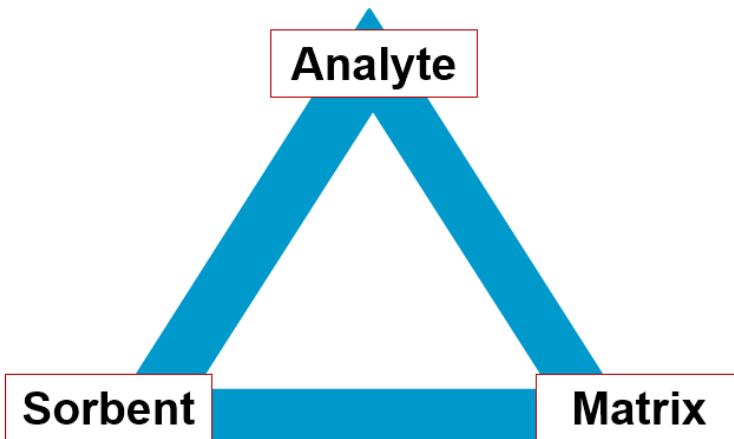
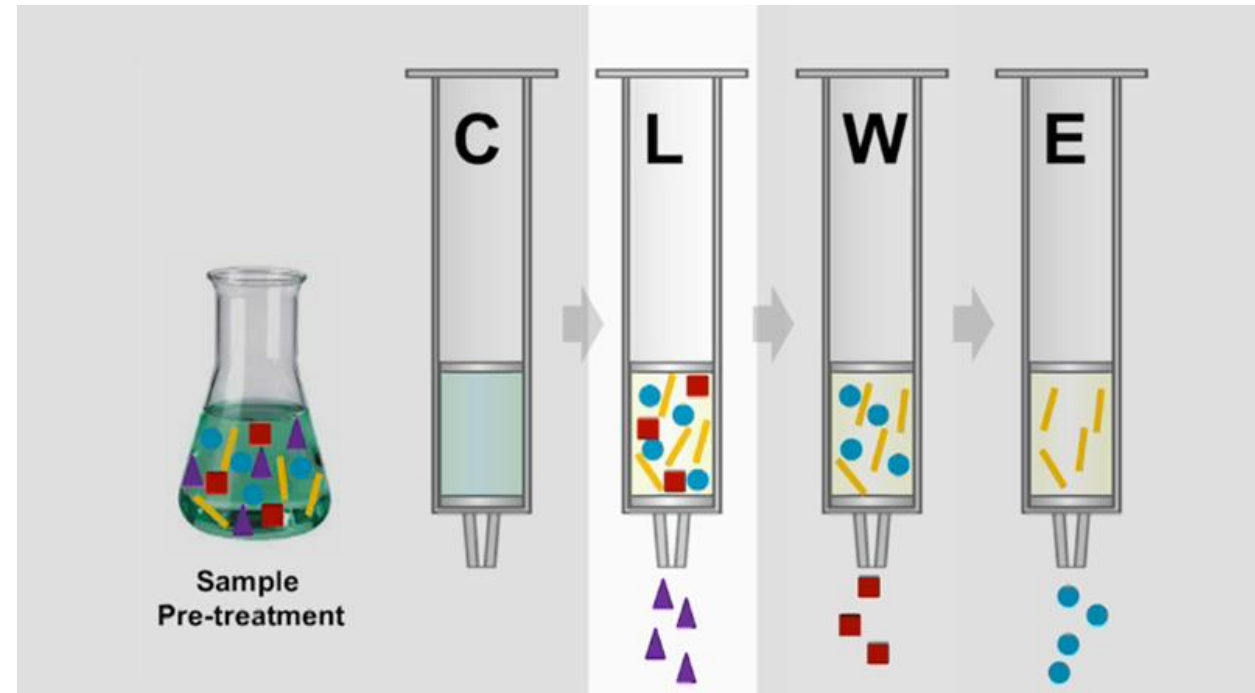
What Happens During Solid Phase Extraction?



Solid Phase Extraction – How?

SPE workflow

- Sample pretreatment
- Condition and equilibrate
- Load
- Wash
- Elute

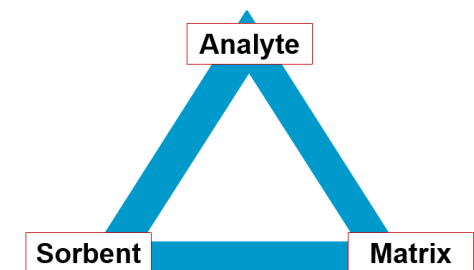
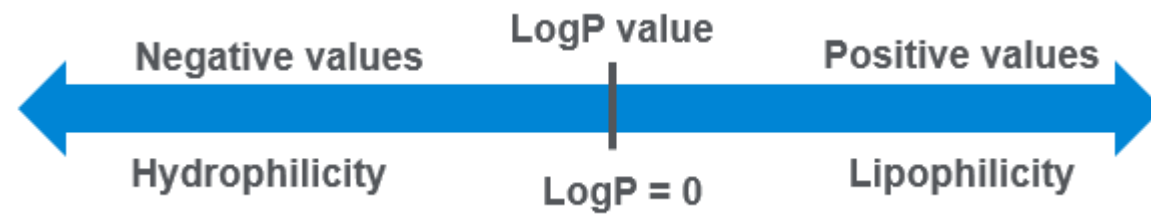


Selecting the Right SPE – How?

- You may not need to start from scratch. Use existing methods as the starting point for your method development.
- Does any LC chromatographic data exist on the analytes?
- Carefully examine the molecular structure of the analyte, its solubility, and other tendencies.
- Consider physical state of the sample, the matrix.
- Consider the analysis technique and its appropriate sample solvent, for example, if derivatization is needed.

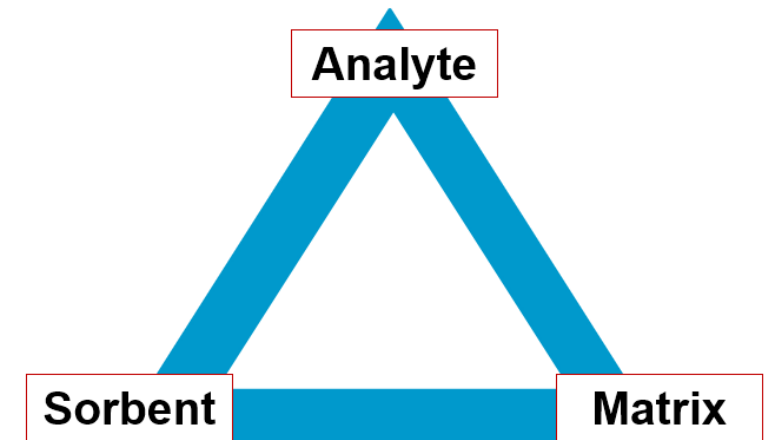
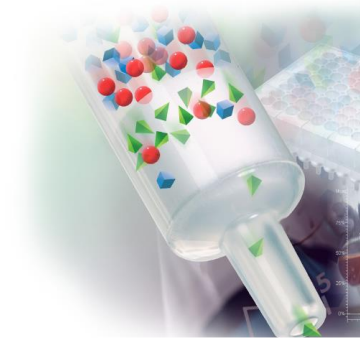
Analyte Considerations

- Is the analyte nonpolar or polar (C, H, N, O)?
- Does the analyte contain any ionic groups?
- Is the analyte a small molecule or a large molecule?
- Is the analyte unstable in acid or base?
- What is the logP and pKa of the analyte?
- What is the approximate concentration of the analyte in the sample?
- Is the analyte likely to undergo nonspecific binding to glassware or plastic?
- What is the detection limit of the analytical system for the analyte?



Matrix Considerations

- What is the sample matrix? Is it polar or nonpolar?
- What are the major interferences in the matrix?
- What are the differences between interferences and analyte?
- Is any sample pretreatment such as pH adjustment necessary?
- Is the matrix viscose, does it need dilution?
- Is an internal standard required?



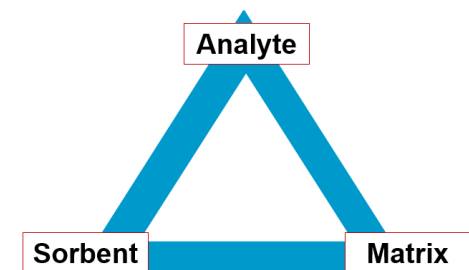
Sample Considerations

- Sample volume
- The number of samples to be processed
- If the sample is solid, how do you process it and extract it?
- Cost per sample
- Sample processing time
- Number of steps involved



SPE Extraction Mechanisms

- **Hydrophobic interaction (nonpolar SPE)**
- Polar interaction
- Ion exchange
- Mixed mode (hydrophobic + ion exchange)
- Other: covalent



Sorbents

- Nonpolar
- Polar
- Cation exchange
- Anion exchange
- Mixed mode
- Covalent
- Specialty sorbents

Silica based

- More than 40 phases and selectivities
- Application-specific phases
- Wide range of published applications
- Method development/optimization may be required

Polymer based

- Simple generic methods
- Less method optimization required
- Faster flow
- Higher capacity
- Greater pH range



Bond Elut SPE- Available Phases

Nonpolar

C18, C8, C2, C1

C18 variations in carbon load and endcapping

EnvirElut

CH – cyclohexyl

CN-E – endcapped cyanopropyl

PH – phenyl

Plexa, PPL, ENV, LMS, Focus, Nexus

Polar

PSA - primary and secondary amine

NH2 - aminopropyl

DEA - diethylaminopropyl

Diol - diol

SI – silica

CN-non-endcapped cyanopropyl

Cation exchange

SCX – benzenesulfonic acid

PRS – propylsulfonic acid

CBA – carboxylic acid

Nexus WCX

Anion exchange

SAX – quaternary amine

PSA – primary and secondary amine

NH2 – aminopropyl

DEA – diethylaminopropyl

Covalent

PBA – phenylboronic acid

Silica/polymeric

Mixed mode IEX/nonpolar

Certify – SCX/C8

Certify II – SAX/C8

Plexa PCX

Plexa PAX

PFAS WAX

Specialty phases

Lipid extraction

AccuCAT

Atrazine

Mycotoxin

Alumina – aluminum oxide

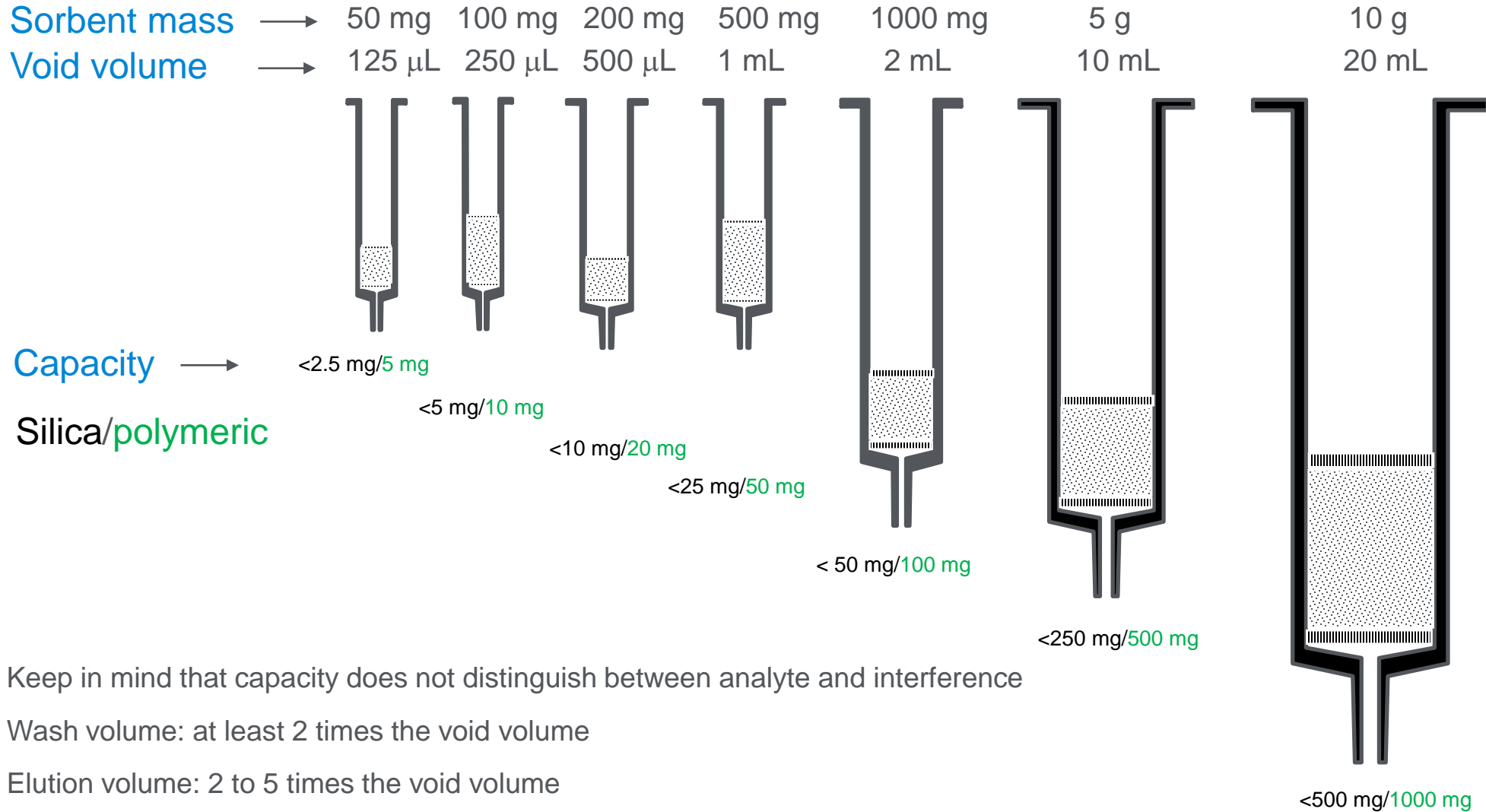
Florisil – magnesium-silica

Carbon S – synthetic carbon

Carbon

Carbon/NH₂

Capacity and Void Volume of Sorbent Packed Bed



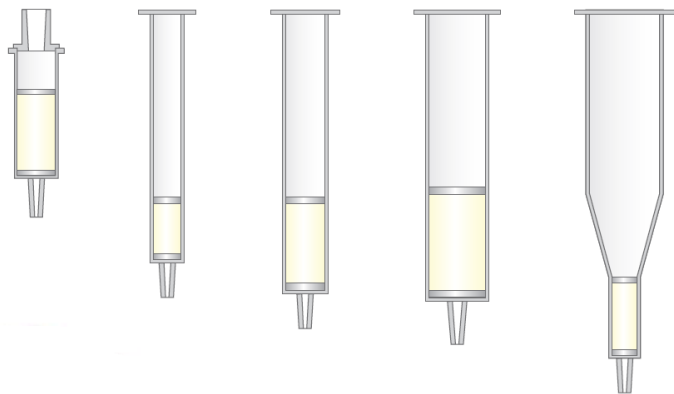
Keep in mind that capacity does not distinguish between analyte and interference

Wash volume: at least 2 times the void volume

Elution volume: 2 to 5 times the void volume

SPE Formats

- Open top cartridge
- Luer top cartridge (Bond Elut Jr)
- 96-well plate (round/square well)
- VersaPlate
- Pipette tip (OMIX)
- Bulk sorbent (Bondesil)



SPE Processing

Vacuum manifolds

- Vac Elut 12
- Vac Elut 20
- Vac Elut SPS 24
- 96-well manifold
- VersaPlate manifold



Positive pressure manifolds

- PPM-48, for cartridges
- PPM-96, for well plates

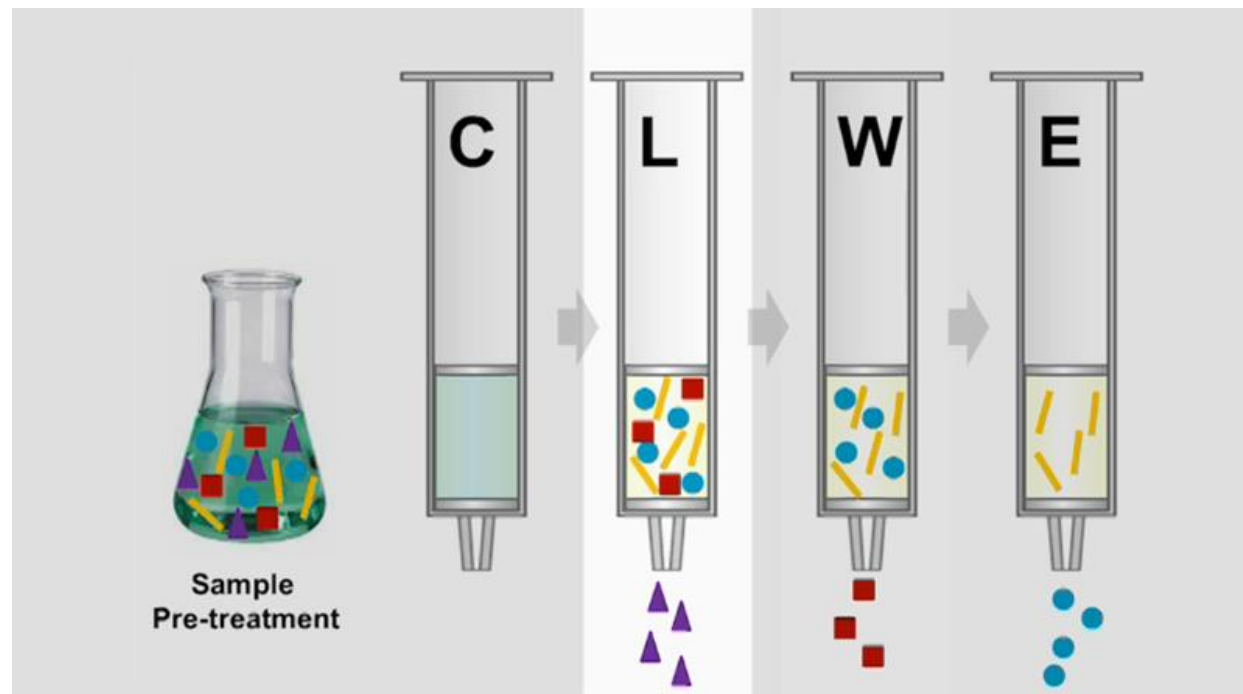


Manual processing for cartridges

Developing SPE Methods and Troubleshooting

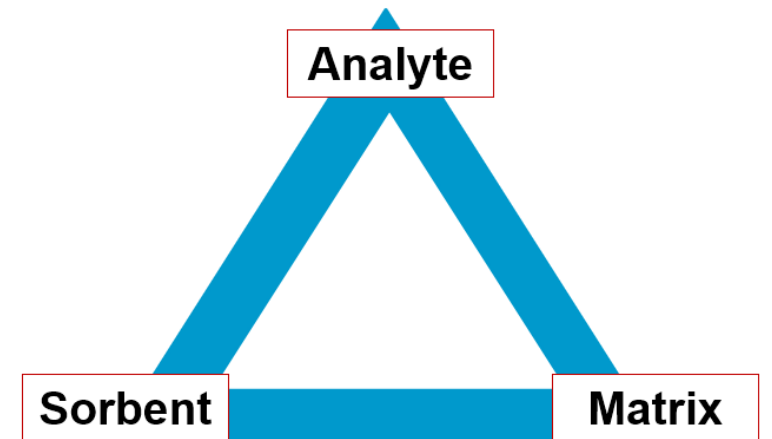
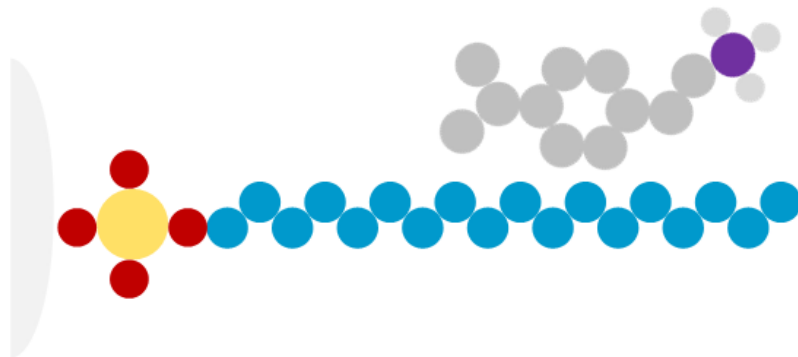
Developing SPE Methods and Troubleshooting

Nonpolar SPE



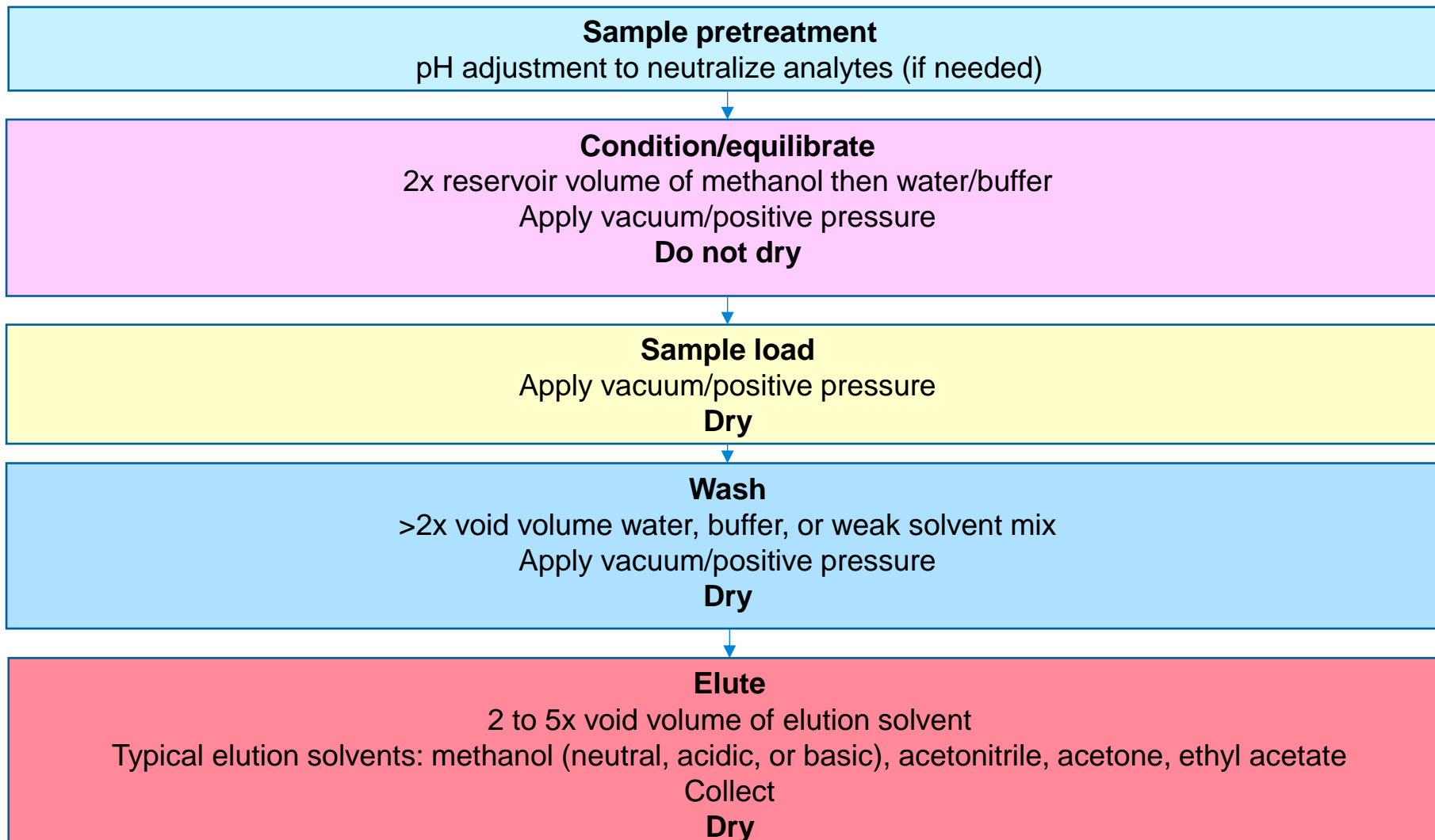
Nonpolar SPE

Compounds with nonpolar functional groups are extracted from polar solutions using nonpolar sorbents (C18, C8, CH, PH, CN-E).



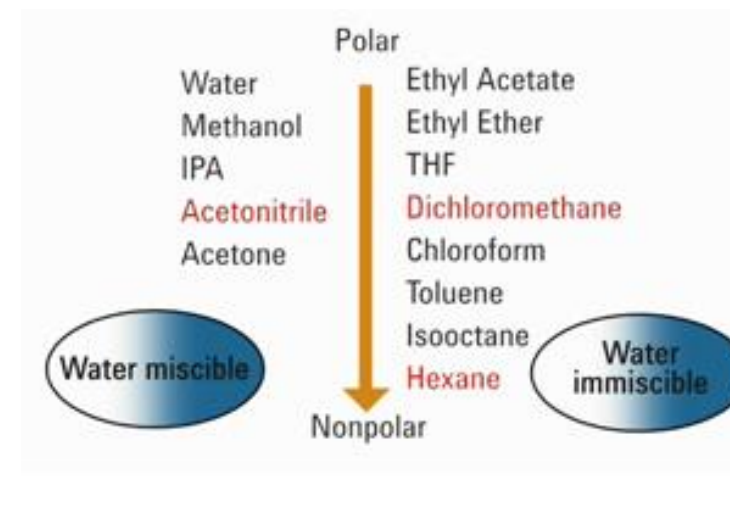
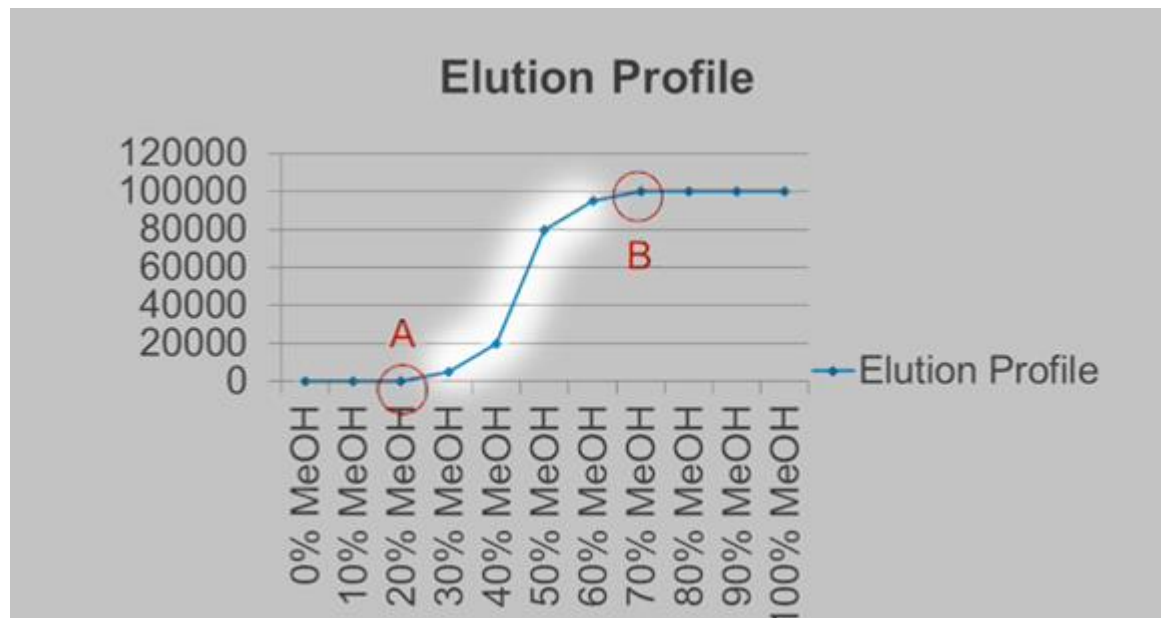
Nonpolar SPE

General extraction procedure



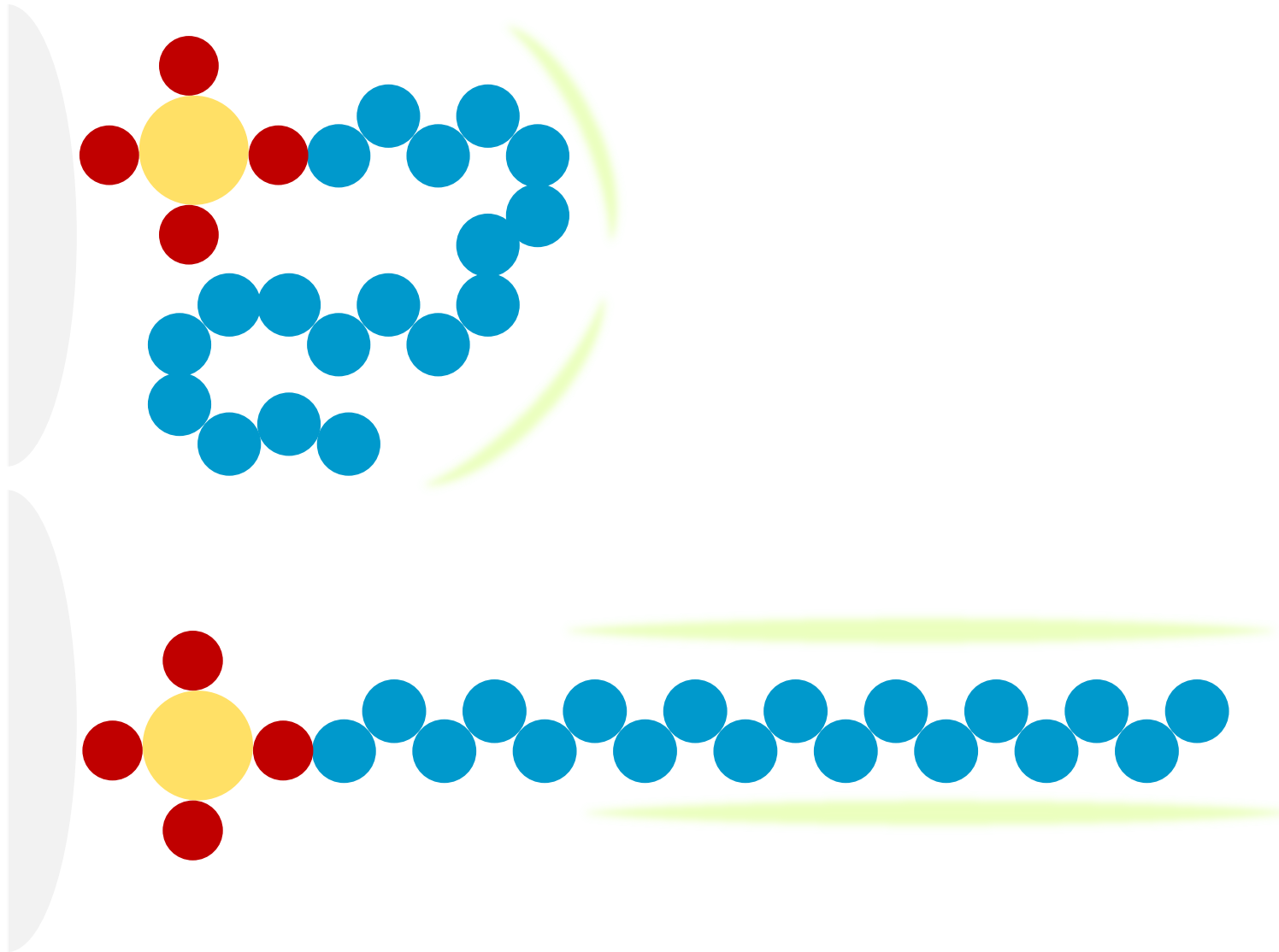
Which elution solvent to use?

10 bottle optimization



Goal: highest analyte recovery with the least number of interferences

Why is Sorbent Conditioning Important?



Nonpolar SPE Troubleshooting



Nonpolar SPE

Troubleshooting

Low recovery

Where is the analyte?

Analyze the effluent of each step (load, wash, and elution).

Symptom: The effluent from the sample load step contains the analyte.

Cause: Inadequate retention

Solution:

- Make the analyte as neutral and hydrophobic as possible by pH adjustment of the sample.
- Make the matrix as polar as possible.
- Make sure that during conditioning/equilibration, the sorbent stays wet.
- Reduce the flow rate, as retention is sometimes improved at lower flow rates. A typical flow rate during sample load is 2 to 4 mL/min.

Nonpolar SPE Troubleshooting

Low recovery

Where is the analyte?

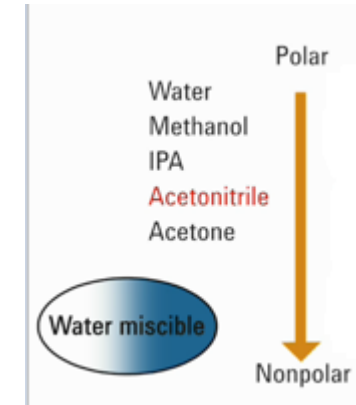
Analyze the effluent of each step (load, wash, and elution).

Symptom: The effluent from the wash step contains the analyte.

Cause: Wash solvent is too strong.

Solution:

- Use a wash solvent like the pretreated sample solvent, with the same pH.
- If the wash solvent is a mix, use separate wash steps with each solvent to see which solvent is eluting the analyte. Then, use a less nonpolar solvent for that step.



Nonpolar SPE Troubleshooting

Low recovery

Where is the analyte?

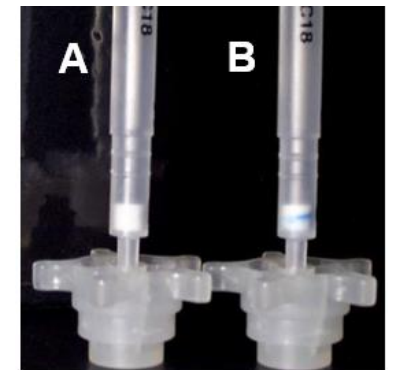
Analyze the effluent of each step (load, wash, and elution).

Symptom: The effluent from the elution step does not contain >90% of the analyte.

Cause: Elution is not complete.

Solution:

- Make sure the analyte is soluble in the selected elution solvent.
- Make sure that the cartridge is dried after the wash and elution steps.
- Try soaking the sorbent with elution solvent.
- Apply the elution solvent in 2 to 3 smaller aliquots.
- Try a stronger elution solvent, or a combination of strong elution solvents.
- If none of the above works, try using a less hydrophobic sorbent.



A: 2 x 100 μ L aliquots
B: 1 x 200 μ L aliquot

Nonpolar SPE

Troubleshooting

Dirty extracts

Symptom: Dirty extracts

Cause: Insufficient cleanup

Solution:

- Increase the organic ratio in the wash solvent or try a multistep wash approach.
- Reduce the strength of the elution solvent.
- Your current sorbent may be too universal. Use a more selective sorbent.
- Try stacking different sorbents or use a mixed-mode sorbent.
- Prerinse the cartridge with the elution solvent.

Nonpolar SPE

Troubleshooting

Variable recovery

Symptom: Irreproducible results

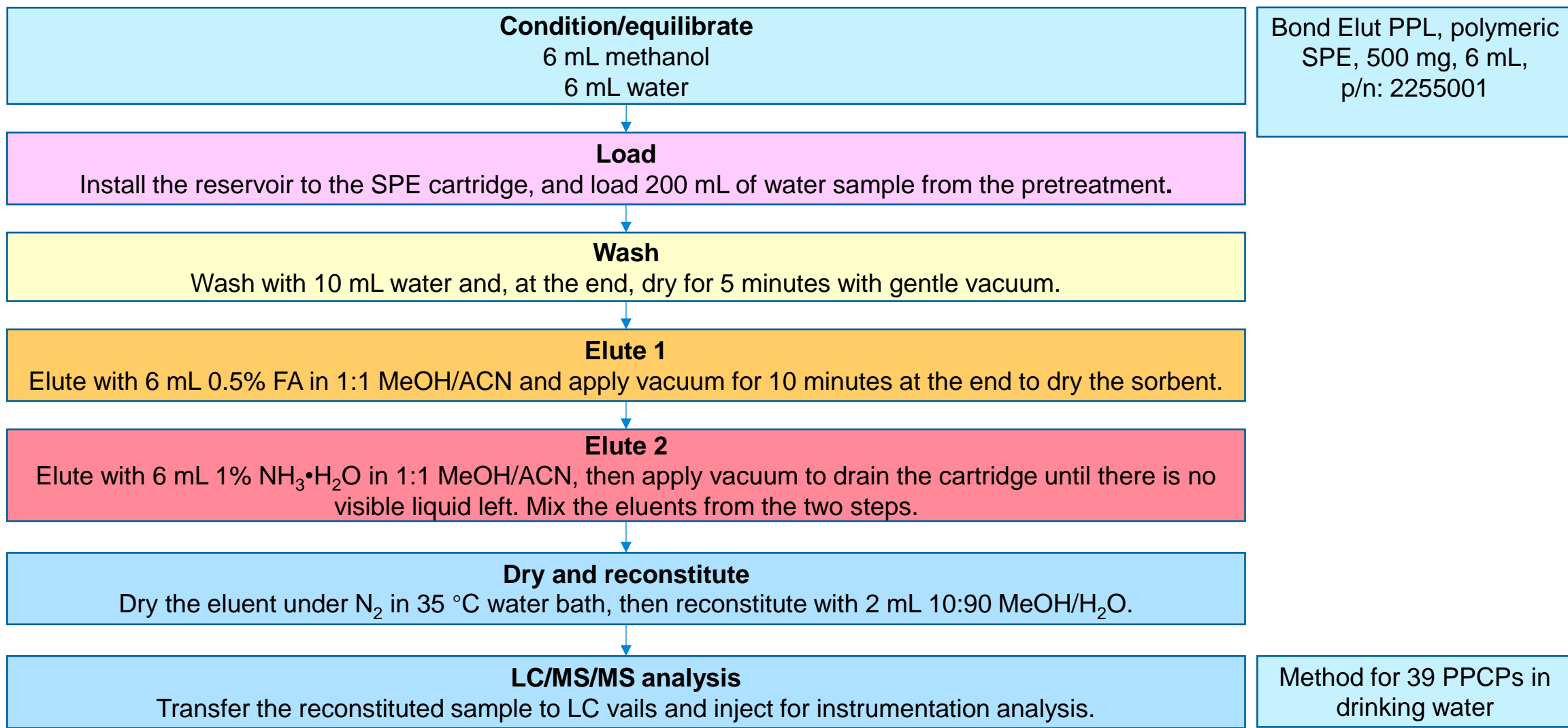
Cause: Partially effective SPE method

Solution:

- Make sure the analyte is completely neutralized during sample pretreatment
- Make sure the sorbent is properly conditioned/equilibrated, and kept wet before sample load
- Try a larger elution volume.
- Try a stronger elution solvent or various buffer/solvent combinations.
- Lipids in the sample can reduce the retention capacity of the sorbent. Use a larger sorbent bed.

Nonpolar SPE Example Method

Bond Elut PPL: excellent for extraction of polar analytes in drinking water



Nonpolar SPE Example Method

Bond Elut Plexa: an easy method for a wide range of analytes in drinking water

Single SPE method for extraction of PAHs, chloropesticides, and triazines

Step	Method
1.	Prerinse cartridge with 6 mL EtOAc, followed by 6 mL DCM
2.	Condition with 10 mL MeOH
3.	Condition with 10 mL H ₂ O
4.	Load 800 mL water sample
5.	Dry sorbent with air for 10 minutes
6.	Soak and collect 2.5 mL fraction using ethyl acetate
7.	Collect 1 mL fraction using ethyl acetate
8.	Soak and collect 2.5 mL fraction using dichloromethane
9.	Collect 1 mL fraction using dichloromethane

Collect with slow
flow, 5 mL/min

Bond Elut Plexa polymeric SPE, 200 mg, 6 mL, p/n: 12109206

List of Analytes Extracted from Drinking Water on Plexa

Chloropesticides

Alachlor
Aldrin
DDD o-p'
DDD p-p'
DDE o-p'
DDE p-p'
DDT p-p'
DDT o-p'
Dieldrin
Endosulfan I (alfa)
Endosulfan II (beta)
Endosulfan sulfato
Endrin
HCH-alfa
HCH-beta
HCH-delta
HCH-gamma
Heptacloro
Heptacloro Epoxido trans
Hexaclorobenceno

Triazines

Desispropylatrazine
Desethylatrazine
Cianazine
Simazine
Atrazine
Terbutrine
Propazine
Tertbutylazine

PAHs

Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Dibenzo(a,h)anthracene
Benzo(ghi)perylene
Indeno(1,2,3-cd)pyrene
Chrysene

With Bond Elut Plexa, all three compound classes can be extracted using a single cartridge with a single SPE method.

Analyzed by

- HPLC-FL/UV for PAHs
- GC/MS for chloroPesticides
- LC/MS/MS for triazines

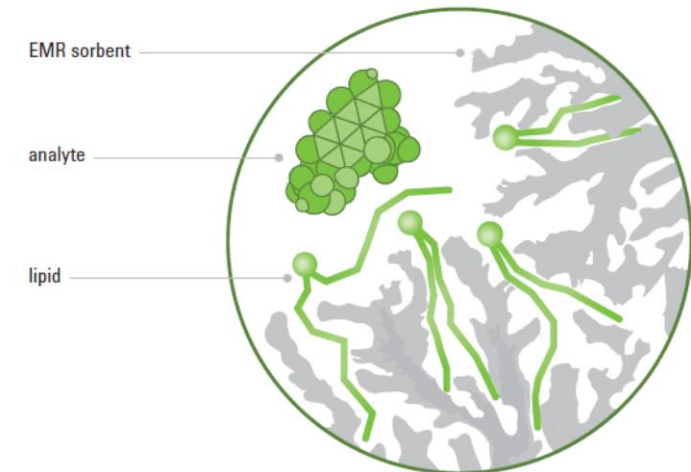
What is New with SPE and Beyond?

Recently introduced SPE products

Bond Elut Lipid Extraction SPE

- EMR-Lipid sorbent is used to remove lipids from a range of sample matrices for analysis of small molecules. Retention of lipids is based on a combination of size exclusion and hydrophobic interaction mechanisms.
- Great alternative to liquid-liquid extraction for extraction of lipidomic samples, requiring smaller volumes of precious sample compared to liquid-liquid extraction.
- Provides better reproducibility and streamlined sample preparation for lipid analysis.
- Proteins precipitated from sample are retained by a filtration process.

Description	Quantity	Part Number
Agilent Bond Elut Lipid Extraction, 1 mL cartridge	100/pk	5610-2041
Agilent Bond Elut Lipid Extraction, 96-well plate	1 plate	5610-2042
Agilent Bond Elut Lipid Extraction, 96-well plate	5 plates	5610-2043



Method guide for 1 mL cartridge: [5994-1627EN](#)

Method guide for 96-well plate: [5994-1690EN](#)

Bond Elut PFAS WAX SPE

Specifically designed, developed, and manufactured for PFAS applications

- Cleanliness
- Sorbent and cartridge formats are compatible with all existing regulated methods
 - EPA method 533 for drinking water
 - EPA method 1633 (draft) for aqueous, solids, biosolids, and tissue samples
 - ISO 21675:2019 for drinking water, sea water, fresh water, and wastewater
- Performance is equivalent to other commercial cartridges
- Fits into existing Agilent PFAS workflows



EPA 533 Drinking water: [5994-4960EN](#)

EPA 1633 Aqueous wastewater: [5994-6879EN](#)

EPA 1633 Soils : [5994-5667EN](#)

Bond Elut PFAS WAX SPE

Property	Specification
Base Polymer	Poly(styrene-co-divinylbenzene) (PSDVB)
Functionalized	Diamino ligand
Chemistry	Weak anion exchange (WAX) and hydrophobic retention
WAX pKa	> 8
Particle size	45 μ m

Part Number	Description
5610-2150	Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk
5610-2151	Bond Elut PFAS WAX, 200 mg, 6 mL, 30/pk
5610-2152	Bond Elut PFAS WAX, 500 mg, 6 mL, 30/pk



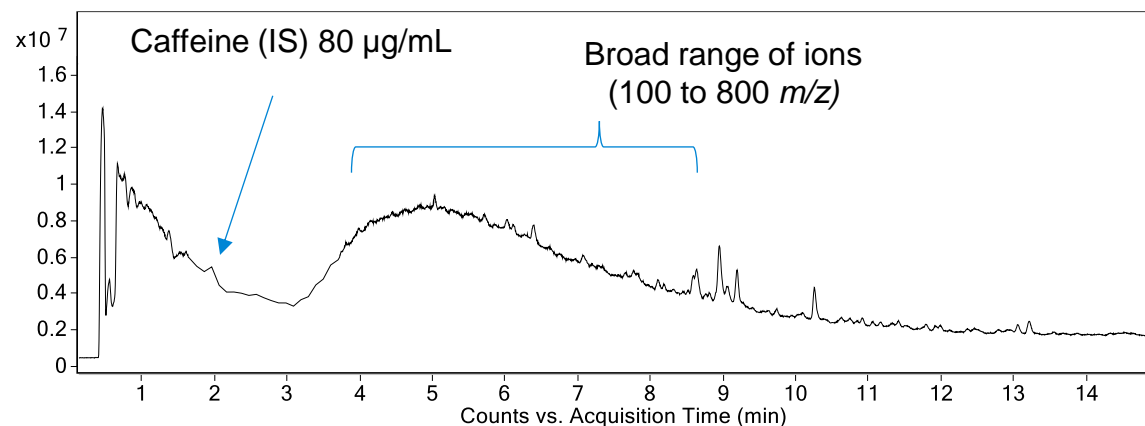
Bond Elut PFAS WAX brochure: [5994-4996EN](#)

Bond Elut PFAS WAX SPE

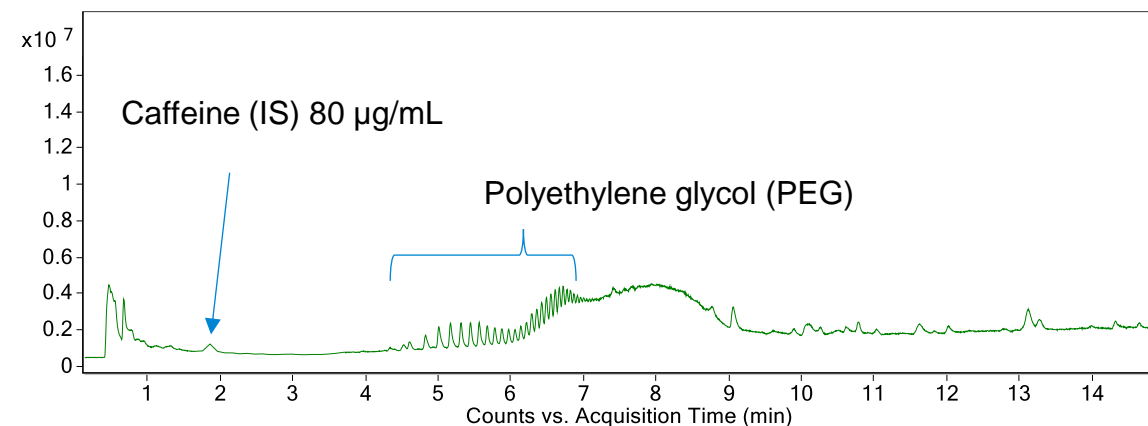
Untargeted blank results

Comparison to other commercial sorbents (positive ion mode)

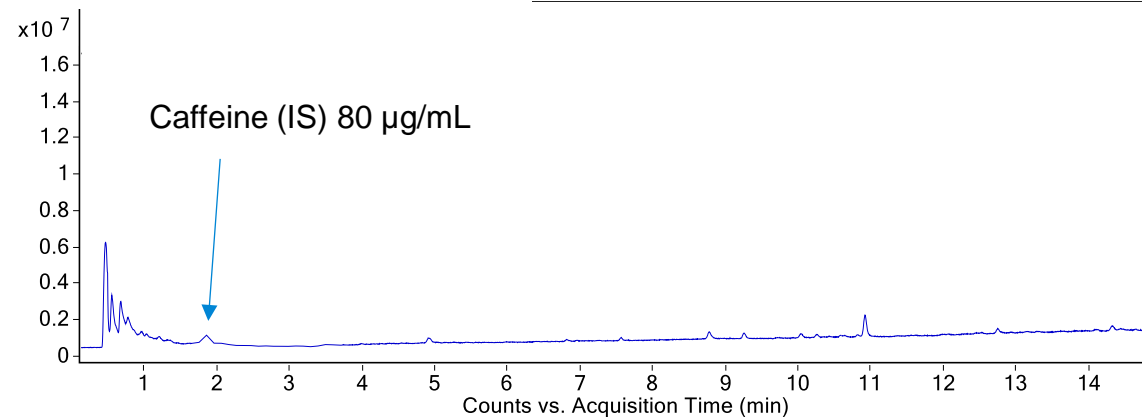
Benchmark cartridge A



Benchmark cartridge B



Bond Elut PFAS WAX



Bond Elut PFAS WAX SPE

Certificate of Analysis (CoA)

Agilent Product Name: Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk

Agilent Part Number: 5610-2150

FG Lot Number: 6678914-01

Media Lot Number: 0006678914

Raw Materials

Component Properties			
Properties	Specifications	Results	Methods
Tube Purity	Proprietary	Pass	GC FID Test
Frit Purity	Proprietary	Pass	HPLC QQQ Test

Product Specifications/Analysis

Polymeric Sorbent Properties			
Properties	Specifications	Results	Methods
Nitrogen Loading (%N)	1.6-2.1	1.9	CHND-S Analysis
Average Particle Size D50(µm)	40.0-55.0	46.2	Laser Diffraction
Average Pore Diameter (Å)	50.0-250.0	157.5	Nitrogen Adsorption Isotherm
Turbidity (NTU)	≤7.0	0.5	Turbidity meter
Washable Residue (mg/g)	≤1.0	0.1	Methanol and Hexane gravimetric
Ion Exchange Capacity (meq/g)	0.40-0.82	0.63	Counter Ion Titration
Cleanliness Test	Proprietary	Pass	GC FID Test
Bed Mass Consistency	Proprietary	Pass	Weight Measurement
Flow Characteristics	Proprietary	Pass	Air Flow Test
PFAS Recovery	Proprietary	Pass	HPLC QQQ Test
PFAS Cleanliness	Proprietary	Pass	HPLC QQQ Test

Visual and Microscopic Properties

Properties	Description
Color	White to Buff
Form and Appearance	Spherical, Free Flowing Beads

New

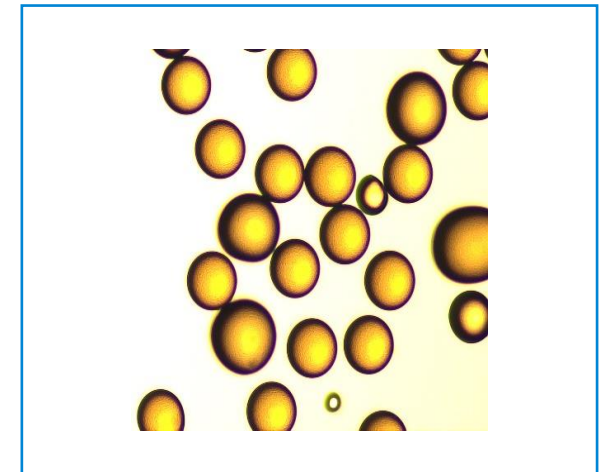
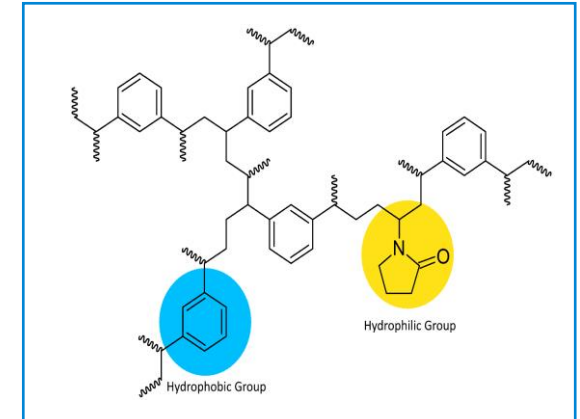


Bond Elut HLB

- **H**ydrophilic-**L**ipophilic **B**alanced (HLB) reversed phase solid phase extraction (SPE) sorbent products
- Composed of monodisperse **divinylbenzene** and **N-vinylpyrrolidone** copolymers
- Hydrophobic divinylbenzene head retains hydrophobic targets well, and hydrophilic N-vinylpyrrolidone head retains polar targets efficiently
- Provides great recovery for a wide range of compounds with different polarity

Features

- Highly wettable
- Highly recoveries with excellent reproducibility
- Higher capacity than Si-based sorbent
- Compatible with solutions from pH 1 to 14



Microscope image of Bond Elut HLB sorbent

Bond Elut HLB

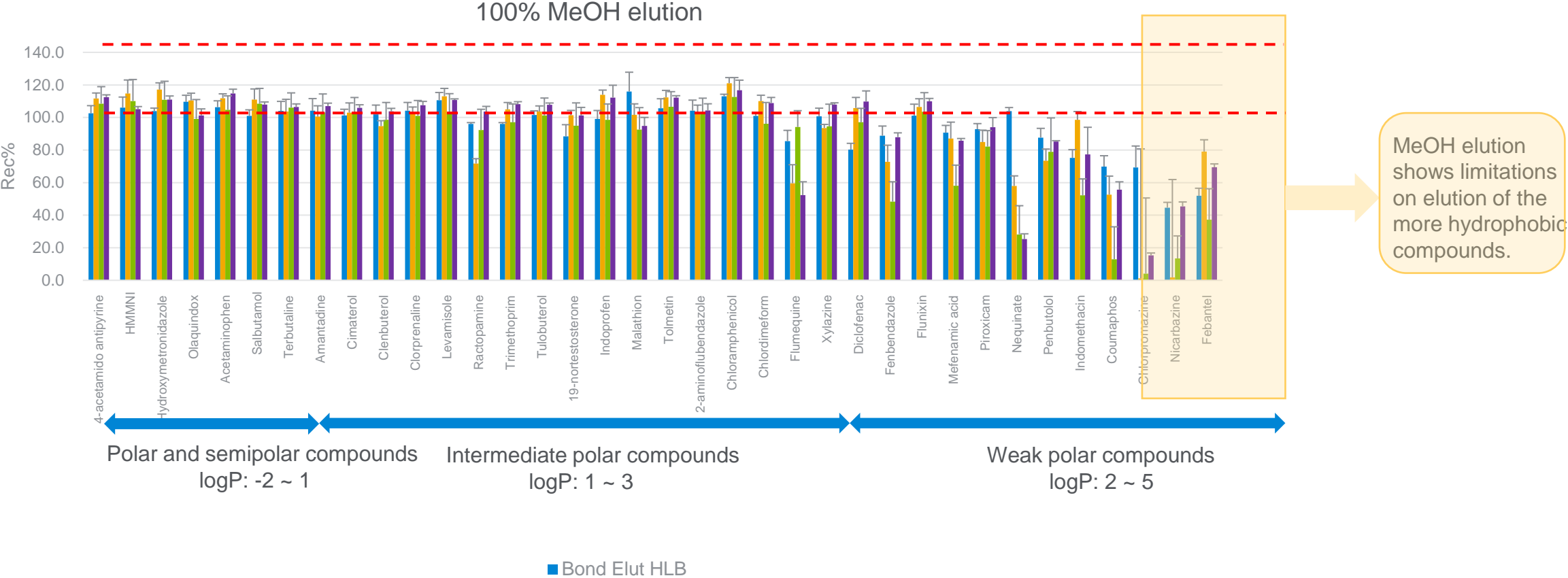
Product information

Part Number	Product Description	Parts per Package
5610-2144	Bond Elut HLB, 30 mg, 1 mL tube	100
5610-2145	Bond Elut HLB, 60 mg, 3 mL tube	50
5610-2146	Bond Elut HLB, 200 mg, 6 mL tube	30
5610-2147	Bond Elut HLB, 500 mg, 6 mL tube	30
5610-2156	Bond Elut HLB, 30 mg, 1 mL 96-well plate	1



Bond Elut HLB Comparison

Recovery and RSD on a large panel of target compounds



What is New with SPE and Beyond?

Recently introduced sample cleanup products

Offline Options for Sample Matrix Removal

		← Instrument separation and detection specificity ←			← Less specific		
		→ Sample preparation specificity →			→ More specific		
Sample Preparation Technique	Interference Removed	Filtration	Supported Liquid Extractions (SLE)	Protein Precipitation and Filtration	QuEChERS	"Targeted Filtration" Protein Precipitation, Filtration, Lipid, and Matrix Removal	Solid Phase Extraction
	Lipids	No	No	No	Yes	Yes	Yes
	Oligomeric Surfactants	No	No	No	No	Yes	Yes
	Particulates	Yes	Some	Yes	Yes	Yes	Yes
	Pigments	No	Some	No	Yes	Yes	Yes
	Polar Organic Acids	No	Yes	No	Yes	No	Yes
	Proteins	No	Yes	Yes	Yes	Yes	Yes
	Salts	No	Yes	No	No	No	Yes
	Suggested Agilent Product	Captiva syringe filters Captiva filter vials	Chem Elut S	Captiva ND	Bond Elut QuEChERS with d-EMR-Lipid and other dispersive	Captiva EMR line	Bond Elut Silica and Polymeric SPE

- Advanced hybrid carbon material with optimized carbon content and pore structure
- Great for removing pigments from highly pigmented food and environmental samples
- Superior results to GCB-based products, which does not cause loss of planar pesticides like GCB

- Simplified workflow and improved recovery

- Offered in a variety of formats:

- Quechers, dSPE mixes
- Bond Elut SPE, packed cartridges
- Captiva EMR filtration cartridges with carbon S
- Bulk powder

- [Captiva EMR with Carbon S | Agilent](#)
- [QuEChERS Dispersive Kits with Carbon S | Agilent](#)
- [Bond Elut Carbon S and Carbon S/NH₂ | Agilent](#)



See appendix for part numbers of Carbon S products

Carbon S

Captiva EMR with Carbon S, selection guide



Captiva EMR-HCF1 (with NH2) & HCF2 (with PSA)

High Chlorophyll Fresh
• Spinach, Arugula, Chard etc.



Captiva EMR-GPF

General Pigmented Fresh
• Berries, Peppers, Broccoli etc.



Captiva EMR-GPD

General Pigmented Dry
• Spices, seasoning, Herbal medicine



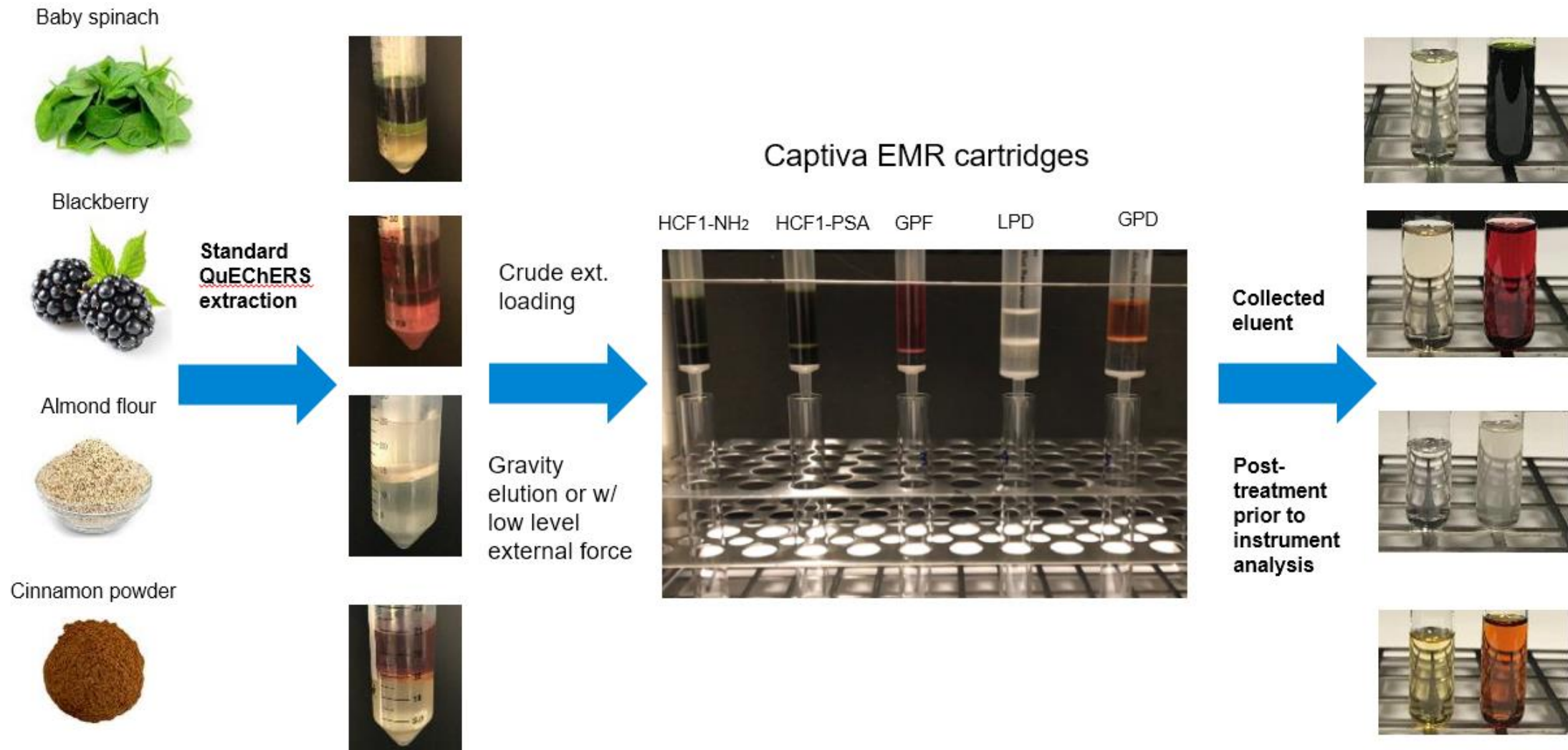
Captiva EMR-LPD

Low Pigmented Dry
• Nuts, tobacco, light pigmented spices

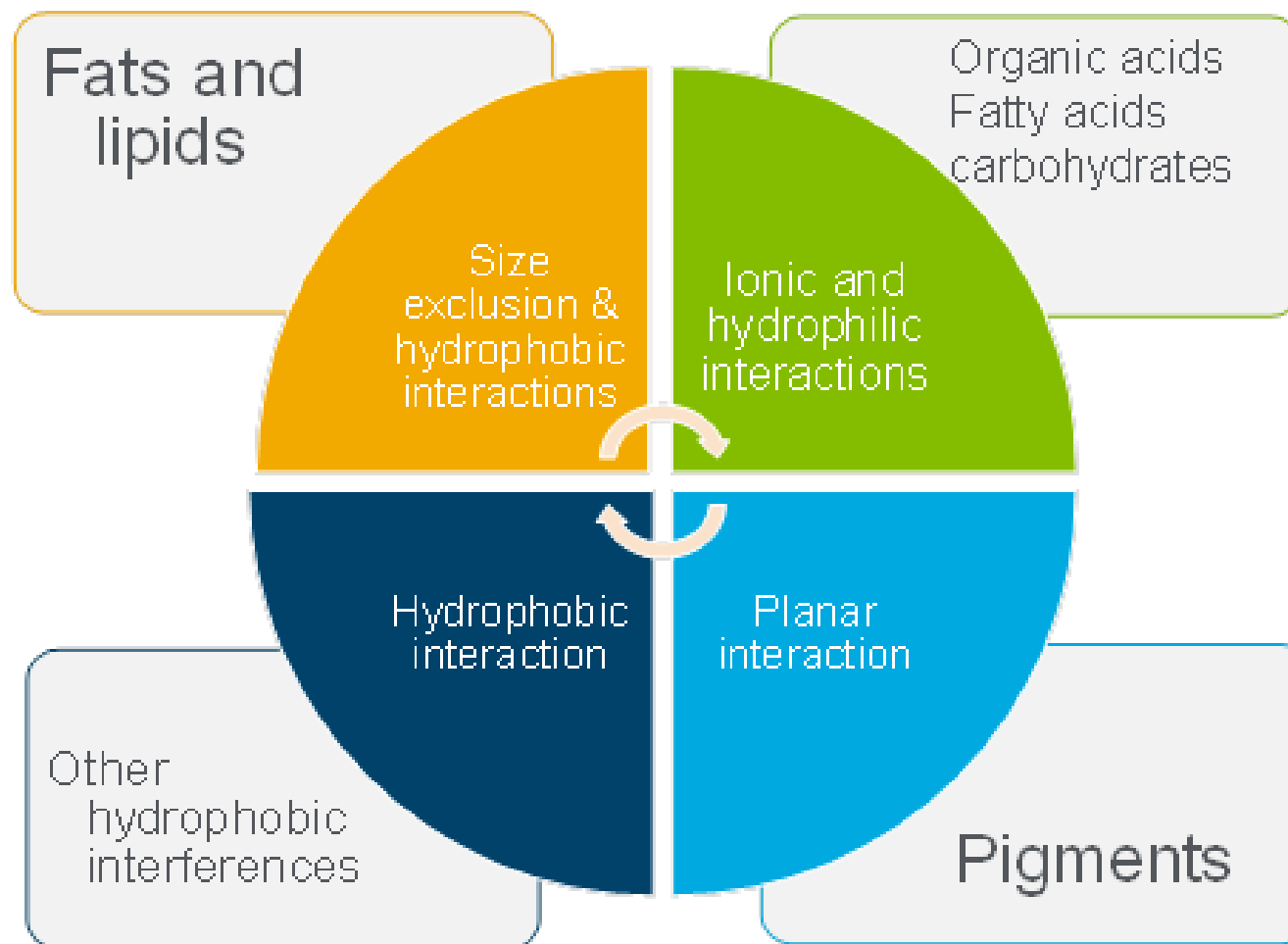
[Captiva EMR | Agilent](#)

Carbon S

Captiva EMR with Carbon S, simplified pass-through workflow for pesticides



Captiva EMR Mixed Mode Passthrough Sample Cleanup



Captiva EMR PFAS Food

- Unique mixed-mode sorbent chemistry and formulation has been specifically optimized and verified for PFAS analysis of food and animal feed matrices
- Two Captiva EMR PFAS Food cartridge types (I and II) are available to cover the large variety of food matrices
 - Captiva EMR PFAS Food I cartridges are recommended for fresh produce and other fresh processed matrices
 - Captiva EMR PFAS Food II cartridges are ideal for animal origin food, dry plant origin food, and other complex food matrices



Plant-origin fresh food



Animal-origin food

Captiva EMR PFAS Food

Sample preparation

Sample extraction



QuEChERS
extraction



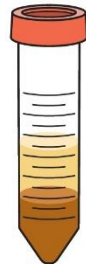
Mechanical
shaking



Centrifuge



Sample cleanup



Sample crude extract



Captiva EMR PFAS
Food cartridges



LC/MS/MS

User Guide: [5994-7302EN](#)

Captiva EMR PFAS Food I & II

Captiva EMR PFAS Food I



- Simpler sorbents and formula
- Applicable for fresh produce and processed plant-origin food
- Used after QuEChERS extraction
- Removes sugars, salts, organic acids, pigments and other hydrophilic and hydrophobic interferences from food matrix
- Two formats provide flexible sample crude extract loading capacity



Captiva EMR PFAS Food I,
6 mL, 340 mg
p/n 5610-2230



Captiva EMR PFAS Food I,
6 mL, 680 mg
p/n 5610-2231

Captiva EMR PFAS Food II



- More comprehensive sorbents and formula
- Applicable for animal-origin food and complex dry food
- Used after QuEChERS extraction
- Removes sugars, salts, organic acids, fats and lipids, pigments and other hydrophobic interferences from food matrices
- One format for generic use in multiple matrices



Captiva EMR PFAS Food II,
6 mL, 750 mg
p/n 5610-2232



Captiva EMR PFAS Food

Sample preparation method comparison

QuEChERS ext. + dSPE + WAX SPE

Ground food sample weighing (1 – 5 g)

Sample hydration when needed

QuEChERS extraction with acidified ACN

dSPE cleanup and filtration with nylon filter

Dilute 1 mL filtrate with water or dry and reconstitute in water

WAX SPE: condition – equilibrate – load – wash - elute

Collect eluent for post-treatment (concentrate)

QuEChERS ext. + Captiva EMR PFAS Food cleanup

Ground food sample weighing (2-10 g)

Sample hydration when needed

QuEChERS extraction w/ acidified ACN

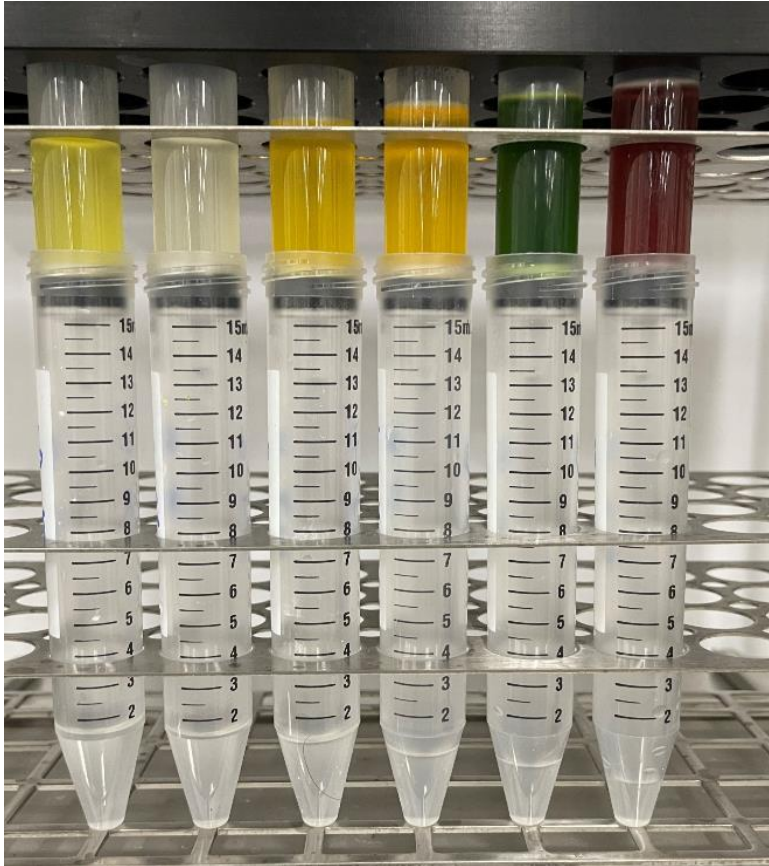
Captiva EMR PFAS Food passthrough cleanup

Collect eluent and for post-treatment (concentrate)

Captiva EMR PFAS Food

Pigment removal – fresh produce (Captiva EMR PFAS Food I)

A) Sample crude extract passthrough cleanup



B) Sample extract appearance, with versus without EMR passthrough cleanup



Orange juice



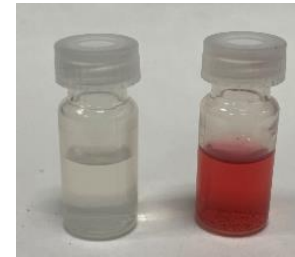
Mushroom



Carrot



Tomato



Grape



Lettuce

Captiva EMR PFAS food passthrough cleanup provides highly efficient pigment removal for fresh produce extract.

[5994-7369EN](#)

Captiva EMR Mycotoxins

- Designed specifically for multi-class mycotoxins in food and feed matrices
- Optimized and verified mixed-mode formula specifically for multi-class mycotoxins analysis, to allow efficient matrix cleanup
- Removes matrix interferences, including carbohydrates, organic acids, lipids and fats, pigments, and other hydrophilic and hydrophobic interferences, while delivering excellent multiclass mycotoxins recovery and reproducibility
- Reduces matrix contamination and accumulation on LC/MS/MS
- 3 mL and 6 mL cartridges

Part Number	Description	Quantity
5610-2233	Captiva EMR Mycotoxins, 3 mL	50/pk
5610-2234	Captiva EMR Mycotoxins, 6 mL	30/pk

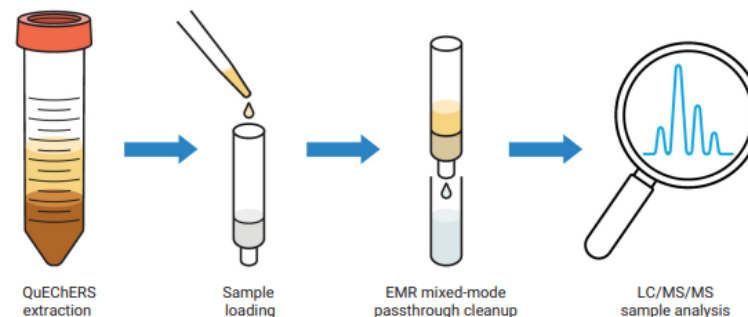


User Guide: [5994-7303EN](#)

Captiva EMR Mycotoxins

Method tips from Agilent Captiva EMR Mycotoxins User Guide

Operating instructions for Agilent Captiva EMR Mycotoxins cartridges



User tips

Sample Size and Pretreatment	Agilent recommends using 1 to 2.5 g of dry sample (homogenized sample powder) for extraction. Add 7.5 to 10 mL of acidic buffer for sample hydration.
Sample Extraction	Perform a modified QuEChERS extraction using ACN with 2% formic acid and QuEChERS extraction salts. The crude sample extract (supernatant) is used for subsequent cleanup. Tip: The stronger acidic extraction solvent is necessary to achieve acceptable mycotoxins recoveries during QuEChERS extraction. Tip: Buffered or nonbuffered QuEChERS extraction salts can be used. Agilent recommends using ceramic homogenizers for your sample extraction. Ceramic homogenizers are effective in breaking up matrix and salt agglomerates for higher extraction recoveries of target analytes. Kits featuring ceramic homogenizers are marked with a CH (ex. 5982-5650CH).
Passthrough Cleanup Procedure Using Captiva EMR Mycotoxins Cartridges	<ol style="list-style-type: none">1. Premix the crude sample extract with 10% water in another 15 mL tube. Gently mix with a pipette. Tip: Agilent recommends performing a cartridge equilibration step before sample loading; this will minimize the impact of cartridge dead volume on final sample eluent volume. For 3 mL cartridges (p/n 5610-2233), add 0.6 mL of sample mixture. Discard eluent. For 6 mL cartridges (p/n 5610-2234), add 0.8 mL of sample mixture. Discard eluent.2. For 3 mL cartridges (p/n 5610-2233), transfer 2 mL of sample mixture to the cartridge. For 6 mL cartridges (p/n 5610-2234), transfer 4 mL of sample mixture to the cartridge.3. Allow the sample to flow using gravity elution. Alternatively, low-level vacuum or positive pressure may be used for elution. Once cartridge flowthrough is stopped, apply high-level vacuum or positive pressure for 1 to 2 minutes to dry the cartridge.4. Collect the eluent and vortex gently.
Sample Post-Treatment	Dilute an aliquot of sample eluent with water to achieve 1:1 ACN/water, then vortex. Tip: When ultralow LOQs are required, a post-concentration drying and reconstitution step may be required.

User Guide:
[5994-7303EN](#)

Captiva EMR Mycotoxins

Pet food

5994-7471EN: Determination of Multiclass Multiresidue Mycotoxins in Pet Food

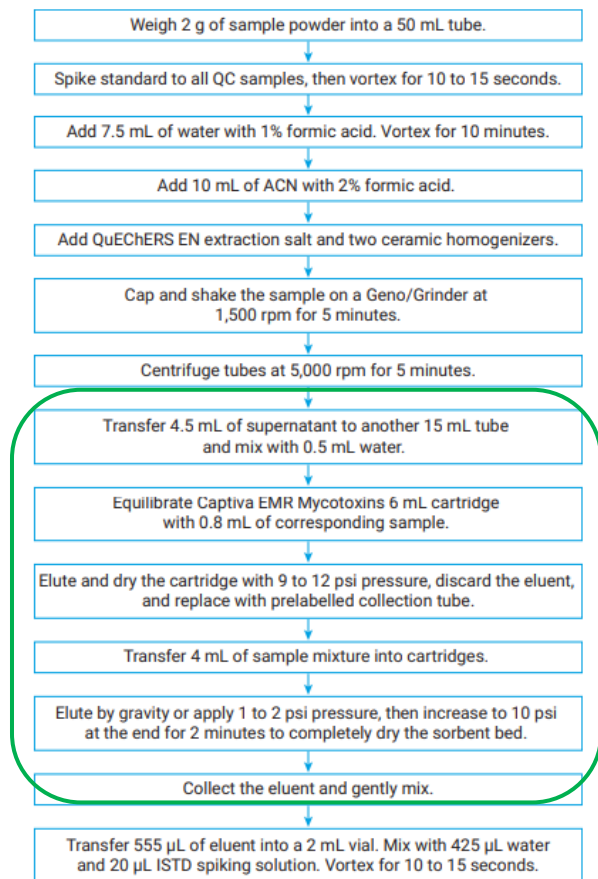
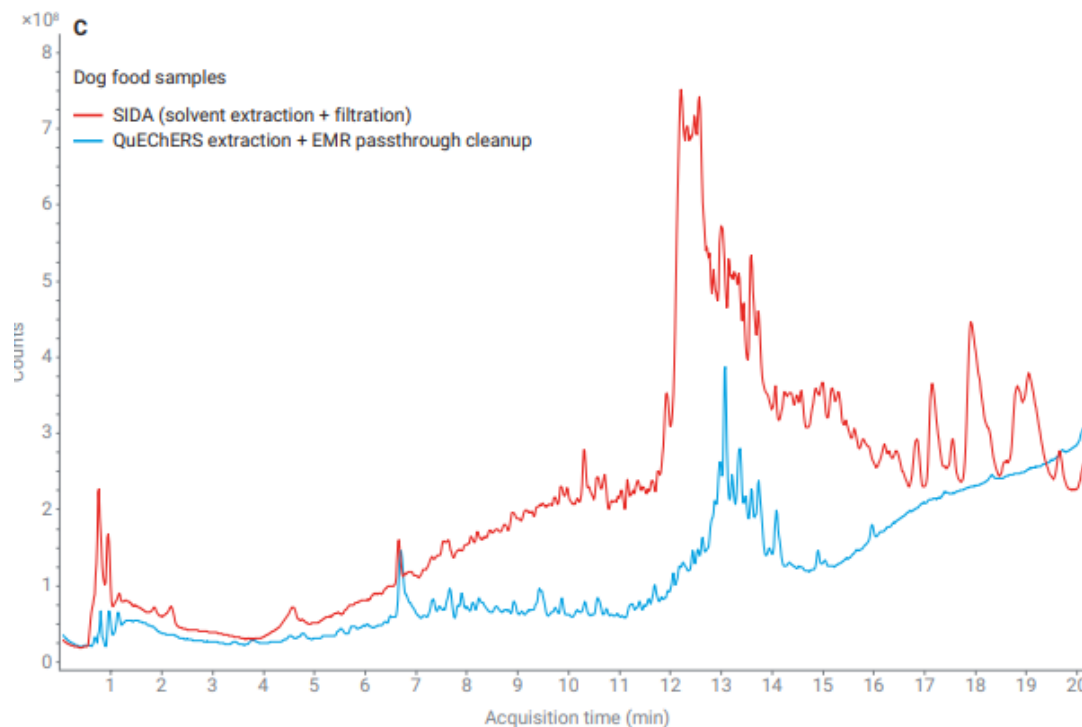
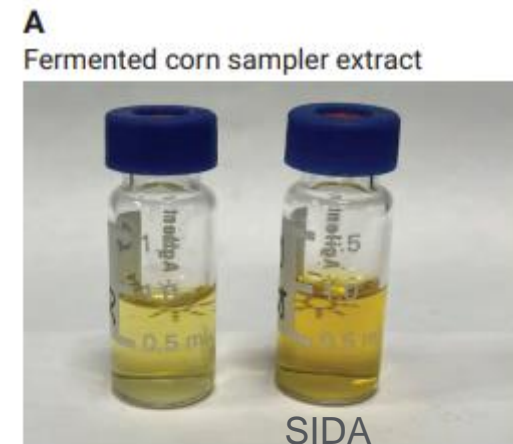


Figure 1. Sample preparation procedure for mycotoxins analysis in pet food powder.



LC/Q-TOF scan. Dog food matrix cleanliness comparison between samples prepared by the SIDA method and Captiva EMR Mycotoxin.



Summary

- Do your research, get to know the properties of target analytes and samples
- Investigate all available options for sample cleanup
- Investigate the analysis technique, solvent compatibility, detection limit
- Narrow down choices of sample cleanup techniques, formats, and processing equipment
- When troubleshooting, change one parameter at a time
- Ask for help:
 - spp-support@agilent.com
 - 800-227-9770, option 3, then option 3, then option 3

Contact Agilent Chemistries and Supplies Technical Support



1-800-227-9770 option 3, option 3:

Option 1 for GC and GC/MS columns and supplies

Option 2 for LC and LC/MS columns and supplies

Option 3 for sample preparation

Option 4 for spectroscopy supplies

Option 5 for chemical standards

Option 6 for former Prozyme products

Available in the U.S. and Canada, 8–5 all time zones

gc-column-support@agilent.com

lc-column-support@agilent.com

spp-support@agilent.com

spectro-supplies-support@agilent.com

chem-standards-support@agilent.com

advancebio.glycan@agilent.com

Web chat: Product pages of [agilent.com](https://www.agilent.com)

Thank You!

Appendix

Carbon S Products

Part numbers

QuEChERS dSPE kits

Description	GCB Part Number	Carbon S Part Number
QuEChERS dSPE TFDA 15 mL, PSA, C18, MgSO ₄ , 50/pk, w/Carbon S	5982-6664	5610-2054
QuEChERS dSPE TFDA 15 mL, animal origin, 50/pk, w/Carbon S	5982-6665	5610-2055
QuEChERS dSPE, ChP TCM, 50/pk, w/Carbon S	5610-2048	5610-2056
QuEChERS dSPE GB 23200.113, tea and spice, 50/pk, w/Carbon S	5982-6670	5610-2057
QuEChERS dSPE 2 mL, universal kit, 100/pk, w/Carbon S	5982-0028	5610-2058
QuEChERS dSPE 2 mL, universal kit w/ceramic homogenizers, 100/pk, w/Carbon S	5982-0028CH	5610-2059
QuEChERS dSPE 15 mL, universal kit, 50/pk, w/Carbon S	5982-0029	5610-2060
QuEChERS dSPE 15 mL, universal kit, 50/pk, w/ceramic homogenizers, w/Carbon S	5982-0029CH	5610-2061
QuEChERS dSPE 2 mL, pigment sample (AOAC like), 100/pk, w/Carbon S	5982-5222	5610-2062
QuEChERS dSPE 2 mL, pigment sample (AOAC like), w/ceramic homogenizers, 100/pk, w/Carbon S	5982-5222CH	5610-2063
QuEChERS dSPE 15 mL, pigment sample (AOAC like), 50/pk, w/Carbon S	5982-5258	5610-2064
QuEChERS dSPE 15 mL, pigment sample (AOAC like), w/ceramic homogenizers, 50/pk, w/Carbon S	5982-5258CH	5610-2065
QuEChERS dSPE 2 mL, fat + pigments (AOAC like), 100/pk, w/Carbon S	5982-5421	5610-2066
QuEChERS dSPE 2 mL, fat + pigments (AOAC like), w/ceramic homogenizers, 100/pk, w/Carbon S	5982-5421CH	5610-2067
QuEChERS dSPE 15 mL, fat + pigments (AOAC like), 50/pk, w/Carbon S	5982-5456	5610-2068
QuEChERS dSPE 15 mL, fat + pigments (AOAC like), w/ceramic homogenizers, 50/pk, w/Carbon S	5982-5456CH	5610-2069
QuEChERS dSPE 2 mL, pigment sample (EN like), 100/pk, w/Carbon S	5982-5221	5610-2070
QuEChERS dSPE 2 mL, pigment sample (EN like), w/ceramic homogenizers, 100/pk, w/Carbon S	5982-5221CH	5610-2071
QuEChERS dSPE 15 mL, pigment sample (EN like), 50/pk, w/Carbon S	5982-5256	5610-2072
QuEChERS dSPE 15 mL, pigment sample (EN like), w/ceramic homogenizers, 50/pk, w/Carbon S	5982-5256CH	5610-2073
QuEChERS dSPE 2 mL, high pigment (EN like), 100/pk, w/Carbon S	5982-5321	5610-2074
QuEChERS dSPE 2 mL, high pigment (EN like), w/ceramic homogenizers, 100/pk, w/Carbon S	5982-5321CH	5610-2075
QuEChERS dSPE 15 mL, high pigment (EN like), 50/pk, w/Carbon S	5982-5356	5610-2076
QuEChERS dSPE 15 mL, high pigment (EN like), w/ceramic homogenizers, 50/pk, w/Carbon S	5982-5356CH	5610-2077

Carbon S Products

Part numbers

Bond Elut SPE

Description	GCB Part Number	Carbon S Part Number
Bond Elut 50 mg, 1 mL, 100/pk, w/Carbon S	126414	5610-2078
Bond Elut 100 mg, 1 mL, 100/pk, w/Carbon S	126418	5610-2079
Bond Elut Jr 250 mg, 100/pk, w/Carbon S	446424	5610-2080
Bond Elut Jr 400 mg, 100/pk, w/Carbon S	466430	5610-2081
Bond Elut 250 mg, 6 mL, 30/pk, w/Carbon S	12102201 or 5982-4432	5610-2082
Bond Elut 500 mg, 6 mL, 30/pk, w/Carbon S	12252201 or 5982-4465	5610-2083
Bond Elut/NH2 500 mg, 6 mL, 30/pk, w/Carbon S	12252202 or 3664325032	5610-2084
Bond Elut 300/NH2 500 mg, 6 mL, 30/pk, w/Carbon S	2264265032 or 5982-4569	5610-2085
Bond Elut 250 mg/PSA 250 mg, 3 mL, 50/pk, w/Carbon S	12102042C250 or 5982-4567	5610-2086
Bond Elut 500 mg/PSA 500 mg, 6 mL, 30/pk, w/Carbon S	12102042C500 or 5982-4568	5610-2087

Carbon S Products

Part numbers

Enhanced Matrix Removal

Description	Carbon S Part Number
Enhanced Matrix Removal high chlorophyll fresh 1 (EMR-HCF1), with NH ₂ , 3 mL, 50/pk	5610-2088
Enhanced Matrix Removal high chlorophyll fresh 2 (EMR-HCF2), with PSA, 3 mL, 50/pk	5610-2089
Enhanced Matrix Removal general pigmented fresh (EMR-GPF), 3 mL, 50/pk	5610-2090
Enhanced Matrix Removal general pigmented dry (EMR-GPD), 6 mL, 30/pk	5610-2091
Enhanced Matrix Removal low pigment dry (EMR-LPD), 6 mL, 30/pk	5610-2092

Bulk Carbon S

Description	Current Part Number	New Part Number
Carbon S bulk, 25 g	5982-4482	5610-2093
Carbon S bulk, 100 g	64100G	5610-2094
Carbon S bulk, 10 g	6410G	5610-2095

Carbon S Products

Part numbers

Sample packs

Part Number	Product description
5610-2096	Bond Elut Carbon, 250mg, 6ml, 3/pk Sample pack of 5610-2082
5610-2097	Bond Elut Carbon, 500mg, 6ml, 3/pk Sample pack of 5610-2083
5610-2098	BE Carbon 500mg/PSA 500mg, 6ml, 3/pk Sample pack of 5610-2087
5610-2099	QuEChERS dispersive SPE kit, ChP TCM, 5/pk Sample pack of 5610-2056
5610-2100	Dispersive, 15ml, Universal kit 5/pk Sample pack Sample pack of 5610-2060
5610-2101	Dispersive SPE 15ml, Pigment Sample EN, 5/pk Sample pack of 5610-2072
5610-2102	Dispersive SPE 15ml, Fat + Pigments AOAC, 5/pk Sample pack of 5610-2068
5610-2103	TFDA QuEChERS dSPE 15mLPSA C18 GCB MgSO4, 5/pk Sample pack of 5610-2054
5610-2104	QuEChERS dSPE GB 23200.113 Tea and Spice, 5/pk Sample pack of 5610-2057
5610-2105	Fresh matrix Enhanced Matrix Removal, sample pack 3-5610-2088, 3-5610-2089 and 3-5610-2090
5610-2106	Dry matrix Enhanced Matrix Removal, sample pack 3-5610-2091 and 3-5610-2092