



Sample Prep

# QuEChERS Made Even Easier:

## Comprehensive Solutions Simplify Sample Prep and Analysis

- Free-flowing salts in slim packets make extraction a snap.
- Complete line of easy-to-use QuEChERS products, reference standards, and accessories.
- Follow up sample prep with a wide range of analytical columns for both LC and GC.



**RESTEK**

Pure Chromatography

**BGB** GC|LC  
MS|CE

# Save Time and Money with QuEChERS

- Free-flowing salts in slim packets make extraction a snap.
- Complete line of easy-to-use QuEChERS products, reference standards, and accessories.
- Follow up sample prep with a wide range of analytical columns for both LC and GC.



For years, the QuEChERS approach to sample preparation has been making the lives of food safety scientists easier. Gone are the days of time-consuming, solvent-intensive extraction techniques and multiple solid phase extraction cartridge cleanup steps! Research published by the U.S. Department of Agriculture Eastern Regional Research Center in Wyndmoor, PA, [1] introduced to the world QuEChERS—a method that is **Quick, Easy, Cheap, Effective, Rugged, and Safe**.

With QuEChERS, a homogenized sample simply undergoes a quick extraction step where the analytes are driven into an organic solvent by the partitioning power of a blend of salts. After extraction, the sample is cleaned up through the use of a dispersive solid phase extraction (dSPE) step that is also quick and easy to perform. This simple, two-stage process offers significant savings in time, materials, and effort, making QuEChERS sample preparation faster and easier than other approaches (Table I).

Since its introduction, the QuEChERS technique has evolved to accommodate an expanding list of pesticides in an increasingly diverse list of foodstuffs. At Restek, we offer Q-sep products to cover the four major approaches to QuEChERS along with a host of other items to help make your QuEChERS experience simple and successful. We carry a comprehensive line of sample prep supplies, reference standards, and LC and GC columns that will help make QuEChERS even easier, whether you are new to the approach or developing a method for a new sample matrix. If you are frustrated with the time and expense of your current pesticide sample cleanup procedure, we suggest you try this simple, economical technique.



**Table I:** Prepare samples more quickly, easily, and cost effectively with QuEChERS.

	Mini-Luke or Modified Luke Method	QuEChERS	Savings with QuEChERS
Estimated time to process 6 samples (min)	120	30	4x faster
Solvent used (mL)	60-90	10	6-9x less solvent
Chlorinated waste (mL)	20-30	0	Safer, cheaper, greener
Glassware/specialized equipment	capacity for 200 mL, quartz wool, funnel, water bath, or evaporator	none	Ready-to-use



**Try QuEChERS risk-free today!**

Call Restek or your local Restek representative to request a free sample pack of Q-sep QuEChERS tubes.

# Quick and Easy...

## Prepare Samples for LC or GC Analysis in Two Simple Stages

### Stage 1: Sample Extraction

Analytes of interest are extracted from the sample through the addition of an organic solvent and a blend of salts. The salts enhance extraction efficiency and allow the normally miscible organic solvent to separate from the water in the sample.



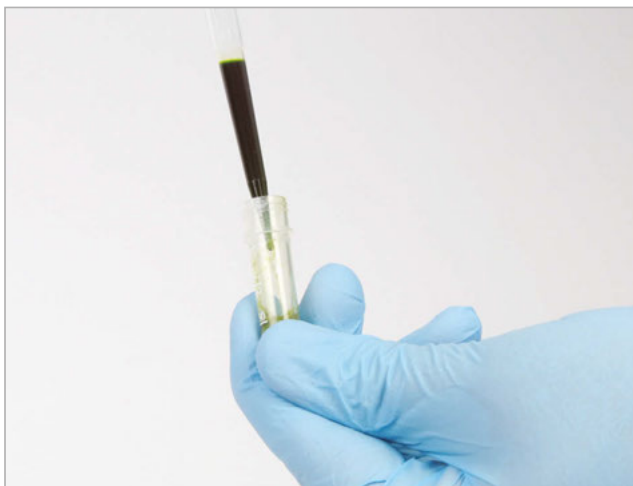
Add acetonitrile and internal standard, then shake vigorously.



Add extraction salts and shake, then centrifuge to separate the phases.

### Stage 2: Sample Cleanup

A subsample of the organic solvent extract from Stage 1 is cleaned up through the use of dSPE. Stage 2 offers a variety of cleanup options that can be selected to match the specific characteristics of your particular sample type (low fat content, highly pigmented, etc.)



Transfer supernatant to dSPE tube.



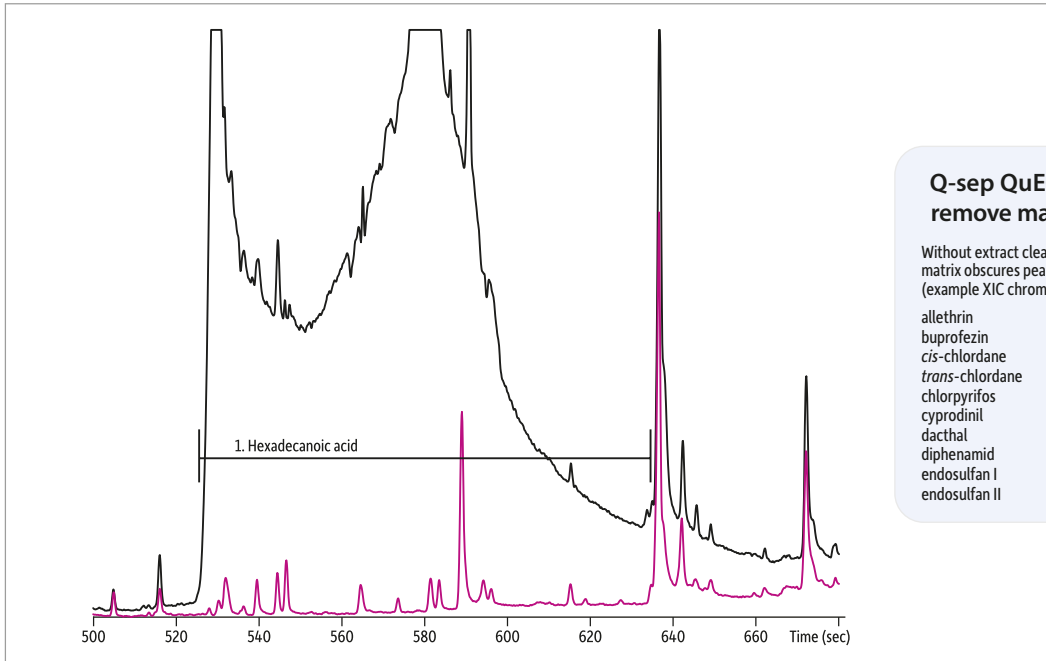
Shake, centrifuge, and transfer to an autosampler vial for analysis by GC or LC.

# Effective...

## QuEChERS dSPE Cleanup Assures Optimal Results for Pesticide Analysis

- Removes matrix interferences that obscure target analytes or cause ion suppression.
- Protects GC inlet, and LC and GC columns from contamination.
- Improves integration and mass spectral matches.

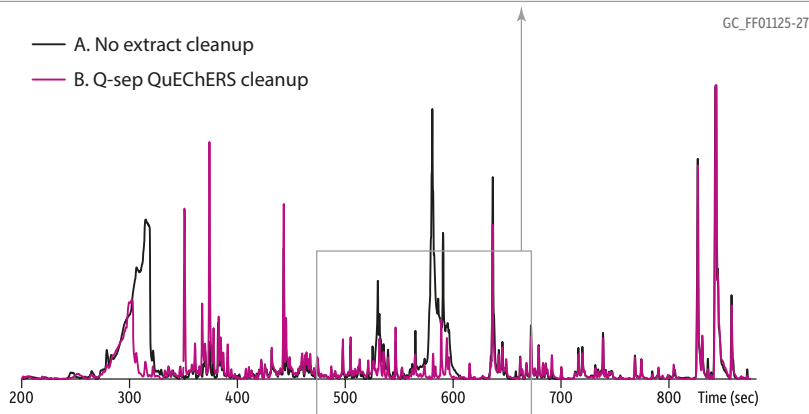
**Figure 1:** QuEChERS dSPE cleanup removes interferences that obscure target pesticides.



### Q-sep QuEChERS tubes easily remove matrix interferences.

Without extract cleanup, hexadecanoic acid from the matrix obscures peaks for all the following pesticides. (example XIC chromatogram = endosulfan I)

- |                         |                        |
|-------------------------|------------------------|
| allethrin               | fenthion               |
| buprofezin              | metolachlor            |
| <i>cis</i> -chlordane   | myclobutanil           |
| <i>trans</i> -chlordane | oxyfluorfen            |
| chlorpyrifos            | pendimethalin          |
| cyprodinil              | pentachlorothioanisole |
| dacthal                 | pirimiphos methyl      |
| diphenamid              | triadimefon            |
| endosulfan I            | triadimenol            |
| endosulfan II           |                        |



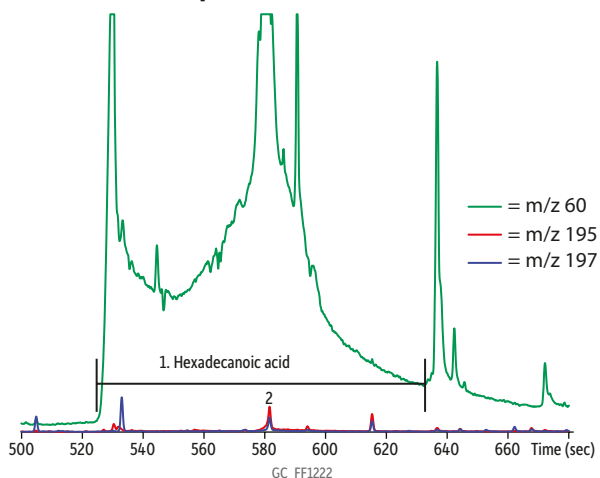
**Column** Rxi-5Sil MS, 20 m, 0.18 mm ID, 0.18  $\mu$ m (cat.# 43602)  
**Sample** Sweet potato spiked with pesticide mix and extracted with acetonitrile and Q-sep QuEChERS EN Method 15662 extraction salts  
**Injection**  
 Inj. Vol.: 1.0  $\mu$ L splitless (hold 1 min)  
 Liner: Gooseneck splitless (4 mm) w/deact. wool (cat.# 22405)  
 Inj. Temp.: 250  $^{\circ}$ C  
**Oven**  
 Oven Temp.: 72.5  $^{\circ}$ C (hold 1 min) to 350  $^{\circ}$ C at 20  $^{\circ}$ C/min  
**Carrier Gas** He, constant flow  
 Flow Rate: 1.2 mL/min

**Detector** MS  
**Mode:** Transfer Line Temp.: 300  $^{\circ}$ C  
**Analyzer Type:** TOF  
**Ionization Mode:** EI  
**Acquisition Range:** 45-550 amu  
**Instrument** Agilent/HP6890 GC  
**Notes**

A. Extract (without cleanup step) acidified with formic acid to pH 5  
 B. Extract with cleanup using Q-sep QuEChERS dSPE cleanup tube (cat.# 26124) acidified with formic acid to pH 5.  
 Scan range: m/z 60, 73, 87, 129, 256 plotted

**Figure 2:** QuEChERS dSPE cleanup significantly improves quantification and identification.

**Without cleanup, matrix masks Endosulfan I.**

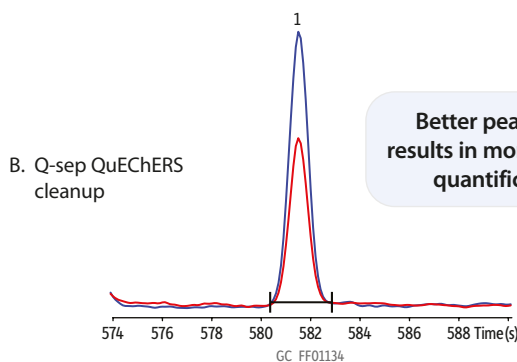
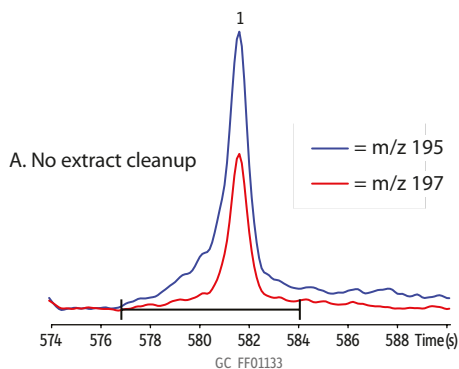


**Peak List**  
 1. Hexadecanoic acid  
 2. Endosulfan I

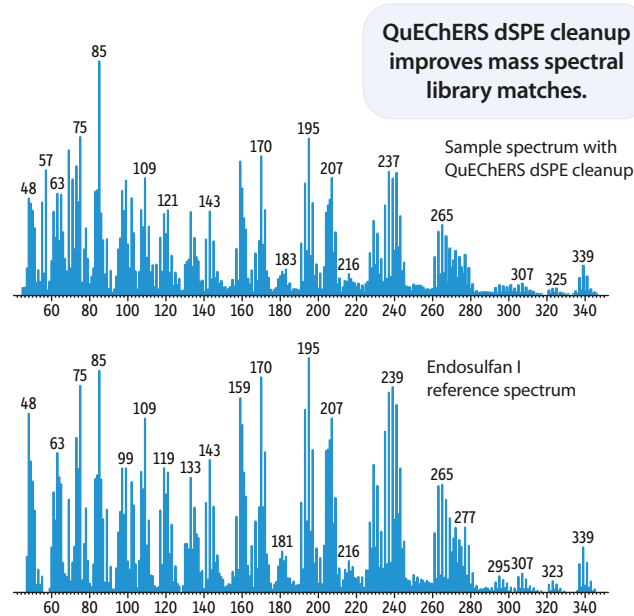
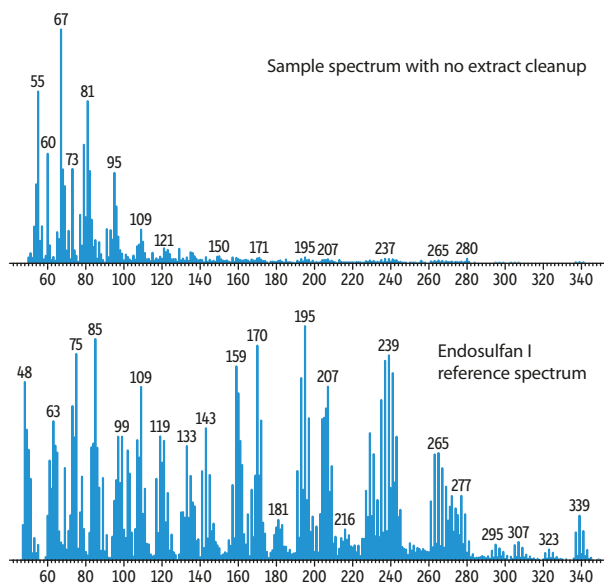
Column: Rxi-5Sil MS, 20 m, 0.18 mm ID, 0.18  $\mu$ m (cat.# 43602)  
 Sample: sweet potato spiked with pesticide mix, extracted with acetonitrile and Q-sep QuEChERS EN Method 15662 extraction salts, then acidified with formic acid to pH 5  
 Inj.: 1.0  $\mu$ L splitless (hold 1 min.), 4 mm single gooseneck liner with w/wool (cat.# 22405)  
 Inj. temp.: 250°C  
 Carrier gas: helium, constant flow  
 Flow rate: 1.2 mL/min.  
 Oven temp.: 72.5°C (hold 1 min.) to 350°C @ 20°C/min.  
 Det: TOFMS  
 Transfer line temp.: 225°C  
 Scan range: 45-550 amu, m/z 60, 195, 197 plotted  
 Ionization: EI  
 Instrument: Agilent 6890, LECO Pegasus III

**QuEChERS dSPE cleanup improves quantification and identification.**

Peak Integration (extracted ion chromatograms)



**Spectral Identification**





# Optimize Analysis with Sorbent Choice

## Choosing a QuEChERS dSPE Sorbent

Primary and secondary amine exchange material (PSA) is the base sorbent used for QuEChERS dSPE cleanup of fruit and vegetable extracts because it removes many organic acids and sugars that might act as instrumental interferences. In addition, C18 or graphitized carbon black (GCB) may be used to remove lipids or pigments, respectively. Choice of sorbent should be based on matrix composition and target analyte chemistry. Most methods make specific recommendations for acidic, basic, and planar pesticides, which may require additional considerations.

As seen in Table II, GCB can have a negative effect on the recoveries of certain pesticides that can assume planar shapes (e.g., chlorothalonil and thiabendazole). The work shown here was done with 50 mg GCB per mL extract, which emphasizes this effect. The EN 15662 QuEChERS method recommends less GCB, which improves recoveries of planar pesticides, but still assures the removal of pigments that can degrade GC-MS performance. To simplify and speed up sample prep, Restek QuEChERS tubes are available in the sorbent combinations and amounts specified by EN 15662 and AOAC methods, as well as in other combinations that may provide better results for difficult matrices (Table III).

**Table II:** Select sorbents based on matrix and target analyte chemistry. (Percent recovery using C18 or GCB, relative to PSA alone).

$t_R$ (min)	pesticide	CAS Number	action/use	classification	C18*	GCB**
9.50	dichlorvos	62-73-7	insecticide	organophosphorus	111	116
9.67	methamidophos	10265-92-6	insecticide	organophosphorus	105	107
11.75	mevinphos	7786-34-7	insecticide	organophosphorus	112	130
12.02	<i>o</i> -phenylphenol	90-43-7	fungicide	unclassified	106	97
12.14	acephate	30560-19-1	insecticide	organophosphorus	128	147
13.89	omethoate	1113-02-6	insecticide	organophosphorus	120	119
14.74	diazinon	333-41-5	insecticide	organophosphorus	108	127
14.98	dimethoate	60-51-5	insecticide	organophosphorus	124	151
15.69	chlorothalonil	1897-45-6	fungicide	organochlorine	125	13
15.86	vinclozolin	50471-44-8	fungicide	organochlorine	102	98
16.21	metalaxyl	57837-19-1	fungicide	organonitrogen	105	117
16.28	carbaryl	63-25-2	insecticide	carbamate	114	111
16.60	malathion	121-75-5	insecticide	organophosphorus	124	160
16.67	dichlofluanid	1085-98-9	fungicide	organohalogen	122	103
17.51	thiabendazole	148-79-8	fungicide	organonitrogen	88	14
17.70	captan	133-06-2	fungicide	organochlorine	88	91
17.76	folpet	133-07-3	fungicide	organochlorine	108	63
18.23	imazalil	35554-44-0	fungicide	organonitrogen	115	95
18.39	endrin	72-20-8	insecticide	organochlorine	104	101
18.62	myclobutanil	88671-89-0	fungicide	organonitrogen	119	114
19.07	4,4-DDT	50-29-3	insecticide	organochlorine	102	95
19.22	fenhexamid	126833-17-8	fungicide	organochlorine	118	77
19.40	propargite 1	2312-35-8	acaricide	organosulfur	110	95
19.43	propargite 2	2312-35-8	acaricide	organosulfur	121	114
19.75	bifenthrin	82657-04-3	insecticide	pyrethroid	106	81
20.04	dicofol	115-32-2	acaricide	organochlorine	98	54
20.05	iprodione	36734-19-7	fungicide	organonitrogen	118	90
20.21	fenpropathrin	39515-41-8	insecticide	pyrethroid	113	96
21.32	<i>cis</i> -permethrin	52645-53-1	insecticide	pyrethroid	106	65
21.47	<i>trans</i> -permethrin	51877-74-8	insecticide	pyrethroid	109	71
23.74	deltamethrin	52918-63-5	insecticide	pyrethroid	97	52

\*50 mg PSA, 50 mg C18, \*\*50 mg PSA, 50 mg GCB      % recovery =  $\frac{\text{RRF C18 or GCB}}{\text{RRF PSA}} \times 100$






Strawberry extracts were spiked at 200 ng/mL with pesticides and subjected to dSPE with PSA only. Results were used to generate single point calibration curves. Spiked extracts were then subjected to additional dSPE sorbents (either C18 or GCB). Results are shown as percent recoveries relative to PSA alone.



**Try QuEChERS risk-free today!**

Call Restek or your local Restek representative to request a free sample pack of Q-sep QuEChERS tubes.

**Table III:** Restek Q-sep dSPE products are formulated with different sorbents in different ratios so that your dSPE choice can be tailored to the composition of your particular sample type (e.g., fatty, highly pigmented, etc.)

Sample Type	Example	Method	Sorbent Mass (mg)				Product Information		
			MgSO <sub>4</sub>	PSA*	C18-EC	GCB**	Vial Volume (mL)	Cat.#	
			Removes						
			Excess water	Sugars, fatty acids, organic acids, anthocyanine pigments	Lipids, nonpolar interferences	Pigments, sterols, nonpolar interferences			
	General fruits and vegetables	Celery, head lettuce, cucumber, melon	AOAC 2007.01	150	50	-	-	2	26124
			Original unbuffered, EN 15662, mini-multiresidue	150	25	-	-	2	26215
			AOAC 2007.01	1200	400	-	-	15	26220
			Original unbuffered, EN 15662	900	150	-	-	15	26223
	Foodstuffs with fats and waxes	Cereals, avocado, nuts, seeds, and dairy	Mini-multiresidue	150	25	25	-	2	26216
			-	150	-	50	-	2	26242
			AOAC 2007.01	150	50	50	-	2	26125
			AOAC 2007.01	1200	400	400	-	15	26221
			-	1200	-	400	-	15	26244
-	900	150	150	-	15	26226			
	Pigmented fruits and vegetables	Strawberries, sweet potatoes, tomatoes	Mini-multiresidue, EN 15662	150	25	-	2.5	2	26217
			AOAC 2007.01	150	50	-	50	2	26123
			AOAC 2007.01	1200	400	400	400	15	26222
			EN 15662	900	150	-	15	15	26224
	Highly pigmented fruits and vegetables	Red peppers, spinach, blueberries	Mini-multiresidue, EN 15662	150	25	-	7.5	2	26218
			AOAC 2007.01	150	50	50	50	2	26219
			EN 15662	900	150	-	45	15	26225
			-	900	300	-	150	15	26126
	General Purpose	Wide range of commodities, including fatty and pigmented fruits and vegetables	-	150	50	50	7.5	2	26243
			-	900	300	300	45	15	26245

Note: No entry in the Method column refers to dSPE formulations not specifically included in one of the cited references. These products can be used to accommodate the various needs of specific matrices not directly met by the cited references.

\*PSA = primary secondary amine exchange material

\*\*GCB = graphitized carbon black

## Q-sep QuEChERS Sample Prep Packets & Tubes



25847

### Q-sep QuEChERS Extraction Salts

- Free-flowing salts transfer easily and completely.
- Easy-open packets eliminate the need for a second empty tube for salt transfer.
- Convenient slim packets fit perfectly into tubes to prevent spills.
- Ready-to-use tubes, no glassware required.
- Pre-weighed, ultra-pure extraction salts.
- Ideal for original unbuffered, AOAC (2007.01), and European (EN 15662) QuEChERS methods.

Description	Material	Method	qty.	cat.#
Q-sep QuEChERS Extraction Kit	4 g MgSO <sub>4</sub> , 1 g NaCl with 50 mL Centrifuge Tube	Original unbuffered	50 packets & 50 tubes	25848
Q-sep QuEChERS Extraction Salt Packets Only	4 g MgSO <sub>4</sub> , 1 g NaCl	Original unbuffered	50 packets	25847
Q-sep QuEChERS Extraction Kit	4 g MgSO <sub>4</sub> , 1 g NaCl, 1 g TSCD, 0.5 g DHS with 50 mL Centrifuge Tube	European EN 15662	50 packets & 50 tubes	25850
Q-sep QuEChERS Extraction Salt Packets Only	4 g MgSO <sub>4</sub> , 1 g NaCl, 1 g TSCD, 0.5 g DHS	European EN 15662	50 packets	25849
Q-sep QuEChERS Extraction Kit	6 g MgSO <sub>4</sub> , 1.5 g NaOAc with 50 mL Centrifuge Tube	AOAC 2007.01	50 packets & 50 tubes	25852
Q-sep QuEChERS Extraction Salt Packets Only	6 g MgSO <sub>4</sub> , 1.5 g NaOAc	AOAC 2007.01	50 packets	25851

*Continued*

DHS – disodium hydrogen citrate sesquihydrate; MgSO<sub>4</sub> – magnesium sulfate; NaCl – sodium chloride; NaOAc – sodium acetate; TSCD – trisodium citrate dihydrate



### Empty Centrifuge Tubes, Polypropylene

Description	qty.	cat.#
Empty 50 mL Centrifuge Tube, Polypropylene w/Cap	50-pk.	25846
	500-pk.	28290

*Continued*



23997

### Empty Centrifuge Tubes, FEP

Sturdy, easy-to-clean FEP (fluorinated ethylene propylene) tubes **last indefinitely** under normal usage conditions—and **cost 50% less!**

Description	Material	qty.	cat.#
Empty 50 mL Centrifuge Tube	FEP (fluorinated ethylene propylene) Tube w/ETFE (ethylene tetrafluoroethylene copolymer) Cap	2-pk.	23997

*Continued*



23990

### Q-sep Bottle Top Solvent Dispenser

- Adjustment knob offers 56 output volume settings from 2.5 mL to 30 mL per stroke (0.5 mL increments)—ideal for QuEChERS methods!
- Base features 30 mm threads and includes five adaptors (28 mm, 32 mm, 36 mm, 40 mm, and 45 mm).
- Individually calibrated in accordance with ISO 8655 standards (certificate included) and can also be recalibrated by the user.
- PTFE, glass, and polypropylene construction for excellent chemical compatibility and 100% autoclavability.
- Integral safety discharge reduces risk of accidental dispensing, and nozzle cap prevents dripping.
- Easy to disassemble for cleaning and servicing.

Accurately and precisely dispense liquids for QuEChERS extractions with this versatile pump. A quick, simple adjustment lets you set the output volume anywhere from 2.5 mL to 30 mL per stroke, and the included adaptors will accommodate most reagent bottles.

Description	qty.	cat.#
Q-sep Bottle Top Solvent Dispenser, 2.5 mL–30 mL	ea.	23990

*Continued*



## Q-sep QuEChERS dSPE Tubes for Extract Cleanup

Fast, Simple Sample Prep for Multiresidue Pesticide Analysis

- Packaged in foil subpacks of 10 for enhanced protection and storage stability.
- Ready-to-use tubes, no glassware required.
- Pre-weighed, ultra-pure sorbents.
- Support original unbuffered, AOAC (2007.01), European (EN 15662), and mini-multiresidue QuEChERS methods.



26216

### Multiple sorbents are used to extract different types of interferences.

MgSO<sub>4</sub>—removes excess water.

PSA (primary and secondary amine)—removes sugars, fatty acids, organic acids, and anthocyanine pigments.

C18-EC (end-capped)—removes nonpolar interferences.

GCB (graphitized carbon black)—removes pigments, sterols, and nonpolar interferences.

Description	Material	Method	Type	Volume	qty.	Similar to Part #	cat.#
<b>Foodstuffs with fats and waxes (e.g., cereals, avocado, nuts, seeds, and dairy)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 25 mg PSA, 25 mg C18-EC	Mini-multiresidue	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes	Agilent 5982-5121	26216
	150 mg MgSO <sub>4</sub> , 50 mg C18-EC	—	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26242
	150 mg MgSO <sub>4</sub> , 50 mg PSA, 50 mg C18-EC	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26125
	1,200 mg MgSO <sub>4</sub> , 400 mg PSA, 400 mg C18-EC	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes	Agilent 5982-5158	26221
	1,200 mg MgSO <sub>4</sub> , 400 mg C18-EC	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26244
	900 mg MgSO <sub>4</sub> , 150 mg PSA, 150 mg C18-EC	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26226
<b>General fruits and vegetables (e.g., celery, head lettuce, cucumber, melon)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 50 mg PSA	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26124
	150 mg MgSO <sub>4</sub> , 25 mg PSA	Original unbuffered, EN 15662, mini-multiresidue	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes	Agilent 5982-5021	26215
	1,200 mg MgSO <sub>4</sub> , 400 mg PSA	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26220
	900 mg MgSO <sub>4</sub> , 150 mg PSA	Original unbuffered, EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes	Agilent 5982-5056	26223
<b>General purpose (wide variety of sample types, including fatty and pigmented fruits and vegetables)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 50 mg PSA, 50 mg C18-EC, 7.5 mg GCB	—	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26243
	900 mg MgSO <sub>4</sub> , 300 mg PSA, 300 mg C18-EC, 45 mg GCB	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26245
<b>Highly pigmented fruits and vegetables (e.g., red peppers, spinach, blueberries)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 25 mg PSA, 7.5 mg GCB	Mini-multiresidue, EN 15662	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26218
	150 mg MgSO <sub>4</sub> , 50 mg PSA, 50 mg C18-EC, 50 mg GCB	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26219
	900 mg MgSO <sub>4</sub> , 150 mg PSA, 45 mg GCB	EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26225
	900 mg MgSO <sub>4</sub> , 300 mg PSA, 150 mg GCB	—	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26126
<b>Pigmented fruits and vegetables (e.g., strawberries, sweet potatoes, and tomatoes)</b>							
Q-sep QuEChERS dSPE Tubes	150 mg MgSO <sub>4</sub> , 25 mg PSA, 2.5 mg GCB	Mini-multiresidue, EN 15662	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26217
	150 mg MgSO <sub>4</sub> , 50 mg PSA, 50 mg GCB	AOAC 2007.01	2 mL Micro-Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (1 mL Extract)	2 mL	100 tubes		26123
	1,200 mg MgSO <sub>4</sub> , 400 mg PSA, 400 mg C18-EC, 400 mg GCB	AOAC 2007.01	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26222
	900 mg MgSO <sub>4</sub> , 150 mg PSA, 15 mg GCB	EN 15662	15 mL Centrifuge Tubes Prefilled with dSPE Materials for Cleanup (6 mL and 8 mL Extract)	15 mL	50 tubes		26224

Continued

Note: No entry in the Method column refers to dSPE formulations not specifically included in one of the cited references. These products can be used to accommodate the various needs of specific matrices not directly met by the cited references.



#### Specifications

<b>Tube Capacity</b>	6 x 50 mL tubes 18 x 15 mL tubes 24 x 2 mL tubes
<b>Dimensions (H x W x D)</b>	9 in x 14.5 in x 17 in (23 cm x 37 cm x 43 cm)
<b>Weight</b>	39 lb (17 kg)
<b>Sound Level</b>	64 dB A
<b>Environmental Range</b>	16–32 °C
<b>Voltage</b>	95–253 VAC
<b>Frequency</b>	50/60 Hz
<b>Power Requirement</b>	220 Watts
<b>Centrifuge Motor</b>	1/2 H.P. Brushless DC
<b>Max g-Force</b>	3450 xg
<b>Max Speed</b>	4500 RPM
<b>Cycle Time</b>	30 sec to 99 min, 59 sec (±2%)

## Q-sep Accessories

### Q-sep Multispeed Centrifuge for QuEChERS

- Program 10 custom cycles for time; braking; and speed or g-force (up to 4500 rpm or 3450 xg).
- QuEChERS-specific presets for AOAC and EN methods make consistent operation quick and simple.
- Convenient lid lighting indicates at a glance if unit is ready, running, or done.
- Control panel can be temporarily locked on one cycle for error-free reproducibility.
- Cool-Flow design prevents samples from overheating by maintaining unit at room temperature.
- Tube holders are carbon fiber for high strength, durability, and years of trouble-free use.
- Clear lid permits safe observation of samples and optical calibration of speed.

Description	Includes	Certification/Compliance	qty.	cat.#
Q-sep Multispeed Centrifuge for QuEChERS	15 mL four-place tube holder (6); 50 mL single-place tube holder (6); 50 mL conical tube insert (6); 2 mL tube adaptors (24); U.S. power cord (1); global/universal power cord (1)	UL61010-1/CSA C22.2 No. 61010-1 and IEC61010-2-020; FDA listed; MET U.S. E112532; CE; RoHS	ea.	28295

*Continued*

#### Intended Use

General-purpose laboratory centrifuge intended for safe and rapid density-based separation of fluids, including physiologic fluids, in approved specimen receptacles for qualitative or quantitative test procedures. As a general-purpose laboratory centrifuge, it is designed to also run other approved containers filled with chemicals (nonflammable, nonexplosive, nonvolatile, and non-highly reactive only), environmental samples, and other nonhuman body samples. This device is intended to be operated by properly trained personnel who have carefully read the operating manual and are familiar with the function of the device.



### Accessories for Q-sep Multispeed and Q-sep 3000 Centrifuges

Description	qty.	cat.#
15 mL four-place tube holder, carbon-fiber material	2-pk.	28293
50 mL single-place tube holder, carbon-fiber material	2-pk.	28294
50 mL conical tube insert	6-pk.	26249
2 mL tube adaptors	4-pk.	26234

*Continued*



### Q-sep Tube Racks

- Available for 2 mL, 15 mL, and 50 mL tubes.
- Alphanumerical grid reference on top tier for easy identification of samples.
- Easy to assemble; simply fold and snap together securely.

Description	Material	Size	qty.	cat.#
Q-sep Tube Rack for 2 mL Centrifuge Tube	Polypropylene, White	Holds 100	ea.	23995
Q-sep Tube Rack for 15 mL Centrifuge Tube	Polypropylene, White	Holds 60	ea.	23993
Q-sep Tube Rack for 50 mL Centrifuge Tube	Polypropylene, White	Holds 24	ea.	23994

*Continued*

## GC and HPLC Columns

### Rxi-5Sil MS Columns (fused silica)

low-polarity phase; Crossbond 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane

- General-purpose columns for GC-MS analysis of most semivolatiles, polycyclic aromatic compounds, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, and hydrocarbons.
- Engineered to be a low-bleed GC-MS column.
- Excellent inertness for active compounds.
- Temperature range: -60 °C to 350 °C.
- Some dimensions also available as Integra-Guard columns — a guard and analytical column in one to eliminate connection problems!

ID	df	Length	Temp. Limits	qty.	Similar to Part #	cat.#
<b>Rxi-5Sil MS</b>						
0.18 mm	0.18 µm	20 m	-60 to 320/350 °C	ea.	Agilent 121-5522UI; Phenomenex 7FD-G030-08	43602
	0.36 µm	20 m	-60 to 320/350 °C	ea.	Agilent 121-5523UI; Phenomenex 7FD-G030-53	43604
0.25 mm	0.25 µm	30 m	-60 to 320/350 °C	ea.	Agilent 122-5532UI; Phenomenex 7HG-G030-11	13623
	0.50 µm	30 m	-60 to 320/350 °C	ea.	Agilent 122-5536UI; Phenomenex 7HG-G030-17	13638

*Continued*

### Raptor ARC-18 LC Columns (USP L1)

- Ideal for high-throughput LC-MS/MS applications with minimal sample preparation.
- Well-balanced retention profile for better detection and integration of large, multiclass analyte lists.
- Sterically protected to endure low-pH mobile phases without sacrificing retention or peak quality.
- Part of Restek's Raptor LC column line featuring 1.8, 2.7, and 5 µm SPP core-shell silica.

ID	Length	qty.	cat.#	
<b>1.8 µm Particles</b>				
2.1 mm	30 mm	ea.	9314232	
	50 mm	ea.	9314252	
	100 mm	ea.	9314212	
	150 mm	ea.	9314262	
3.0 mm	50 mm	ea.	931425E	
	100 mm	ea.	931421E	
<b>2.7 µm Particles</b>				
2.1 mm	30 mm	ea.	9314A32	
	50 mm	ea.	9314A52	
	100 mm	ea.	9314A12	
	150 mm	ea.	9314A62	
3.0 mm	30 mm	ea.	9314A3E	
	50 mm	ea.	9314A5E	
	100 mm	ea.	9314A1E	
	150 mm	ea.	9314A6E	
4.6 mm	30 mm	ea.	9314A35	
	50 mm	ea.	9314A55	
	100 mm	ea.	9314A15	
5 µm Particles	150 mm	ea.	9314A65	
	2.1 mm	50 mm	ea.	9314552
		100 mm	ea.	9314512
		150 mm	ea.	9314562
3.0 mm	30 mm	ea.	931453E	
	50 mm	ea.	931455E	
	100 mm	ea.	931451E	
	150 mm	ea.	931456E	
4.6 mm	50 mm	ea.	9314555	
	100 mm	ea.	9314515	
	150 mm	ea.	9314565	
	250 mm	ea.	9314575	

*Continued*



Restek's low-bleed MS columns exceed requirements of the most sensitive mass spectrometers.

### ordering notes

Custom lengths and film thicknesses available. Contact Technical Service or your local Restek representative.

# Raptor

LC Columns



### similar phases

Accucore XL C18; Ascentis Express Peptide ES-C18; Kinetex XB-C18; Poroshell 120 SB-C18



## Topaz GC Inlet Liners

Topaz GC inlet liners feature revolutionary technology and inertness to deliver you the next level of True Blue Performance:

- **Deactivation**—unbelievably low breakdown for accurate and precise low-level GC analyses.
- **Reproducibility**—unbeatable manufacturing controls and QC testing for superior reliability across compound classes.
- **Productivity**—unparalleled cleanliness for maximized GC uptime and lab throughput.
- **100% Satisfaction**—if a liner doesn't perform to your expectations, we will replace it or credit your account.\*

Patented

### Topaz 4.0 mm ID Single Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets



ID x OD x Length	qty	Similar to Part #	cat.#
<b>Single Taper, Premium Deactivation, Borosilicate Glass</b>			
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	Agilent 5181-3316 (ea.), 5183-4695 (5-pk.), 5183-4696 (25-pk.), 5190-2292 (ea.), 5190-3162 (5-pk.), 5190-3166 (25-pk.), 5190-3170 (100-pk.)	23302

*Continued*

### Topaz 4.0 mm ID Single Taper Inlet Liner w/ Wool

for Agilent GCs equipped with split/splitless inlets



ID x OD x Length	Packing	qty	Similar to Part #	cat.#
<b>Single Taper, Premium Deactivation, Borosilicate Glass</b>				
4.0 mm x 6.5 mm x 78.5 mm	Quartz Wool	5-pk.	Agilent 5062-3587 (ea.), 5183-4693 (5-pk.), 5183-4694 (25-pk.), 5190-2293 (ea.), 5190-3163 (5-pk.), 5190-3167 (25-pk.), 5190-3171 (100-pk.)	23303

*Continued*

### Topaz 4.0 mm ID Cyclo Double Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets



ID x OD x Length	qty	cat.#
<b>Cyclo Double Taper, Premium Deactivation, Borosilicate Glass</b>		

*Continued*

### Topaz 4.0 mm ID Double Taper Inlet Liner

for Agilent GCs equipped with split/splitless inlets



ID x OD x Length	qty	Similar to Part #	cat.#
<b>Double Taper, Premium Deactivation, Borosilicate Glass</b>			
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	Agilent 5181-3315 (ea.), 5183-4705 (5-pk.), 5183-4706 (25-pk.), 5190-3983 (ea.), 5190-4007 (5-pk.)	23308

ID x OD x Length	qty	cat.#
4.0 mm x 6.5 mm x 78.5 mm	5-pk.	23310

*Continued*

\* 100% SATISFACTION GUARANTEE: If your Topaz inlet liner does not perform to your expectations for any reason, simply contact Restek Technical Service or your local Restek representative and provide a sample chromatogram showing the problem. If our GC experts are not able to quickly and completely resolve the issue to your satisfaction, you will be given an account credit or replacement product (same cat.#) along with instructions for returning any unopened product. (Do not return product prior to receiving authorization.) For additional details about Restek's return policy, visit [www.restek.com/warranty](http://www.restek.com/warranty)

## QuEChERS Performance Standards

- Designed for use in all QuEChERS methods for pesticides in fruits and vegetables, including the original unbuffered method, AOAC 2007.01, and EN15662.
- Ideal for initial method evaluations and ongoing method performance validations.
- Optimized blend of chemically compatible analytes for maximum stability and shelf life.
- Precise formulation improves data quality and operational efficiency; spend more time running samples and less time sourcing and preparing standards.
- Quantitatively analyzed to confirm the composition and stability of each mixture.



### QuEChERS Performance Standard A

(16 components)

Acephate (30560-19-1)	Diazinon (333-41-5)	Fenthion (55-38-9)	Omethoate (1113-02-6)
Azinphos methyl (86-50-0)	Dichlofluanid (1085-98-9)	Malathion (121-75-5)	Phosalone (2310-17-0)
Chlorpyrifos (2921-88-2)	Dichlorvos (DDVP) (62-73-7)	Methamidophos (10265-92-6)	Pirimiphos methyl (29232-93-7)
Coumaphos (56-72-4)	Dimethoate (60-51-5)	Mevinphos (7786-34-7)	Propargite (2312-35-8)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Performance Standard A</b>							
300 µg/mL each in acetonitrile:acetic acid (99.9:0.1), 1 mL/ampul	Yes	3 months	12 months	Ambient	10 °C or colder	ea.	31153

*Continued*

### QuEChERS Performance Standard B

(7 components)

gamma-BHC (Lindane) (58-89-9)	4,4'-DDT (50-29-3)	Endosulfan sulfate (1031-07-8)	2-Phenylphenol (90-43-7)
Chlorothalonil (1897-45-6)	Dicofol (Kelthane) (115-32-2)	Endrin (72-20-8)	

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Performance Standard B</b>							
300 µg/mL each in acetonitrile:acetic acid (99.9:0.1), 1 mL/ampul	Yes	6 months	24 months	Ambient	10 °C or colder	ea.	31154

*Continued*

### QuEChERS Performance Standard C

(17 components)

Bifenthrin (82657-04-3)	Deltamethrin (52918-63-5)	Imazalil (35554-44-0)	Myclobutanil (88671-89-0)	Vinclozolin (50471-44-8)
Captan (133-06-2)	Fenhexamid (126833-17-8)	Iprodione (36734-19-7)	cis-Permethrin (61949-76-6)	
Carbaryl (Sevin) (63-25-2)	Fenpropathrin (39515-41-8)	Metalaxyl (57837-19-1)	trans-Permethrin (61949-77-7)	
Cyprodinil (121552-61-2)	Folpet (133-07-3)	Methiocarb (2032-65-7)	Thiabendazole (148-79-8)	

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Performance Standard C</b>							
300 µg/mL each in acetonitrile:acetic acid (99.9:0.1), 1 mL/ampul	Yes	6 months	24 months	Ambient	10 °C or colder	ea.	31155

*Continued*

### QuEChERS Performance Standards Kit

- Kit contains organochlorine, organonitrogen, organophosphorus, and carbamate pesticides commonly used on fruits and vegetables.
- Volatile, polar, active, base-sensitive, and nonvolatile compounds are included to allow comprehensive evaluation of QuEChERS extraction and cleanup efficiencies, and optimization of GC and LC instrumental conditions.
- Analytes are divided into three ampuls based on compatibility for maximum stability and shelf life.\*

\*When combining compounds with different functionalities, chemical stability can be an issue. The analytes in this kit are separated into three mixes to ensure maximum long-term storage stability. For analysis, a fresh working standard should be prepared by combining the three kit mixes in a 1:1:1 ratio to prepare a 100 µg/mL working standard solution. Once blended, Restek does not recommend storing working standards or subsequent dilutions for future use.

Contains 1 mL each of these mixtures. 31153: QuEChERS Performance Standard A 31154: QuEChERS Performance Standard B 31155: QuEChERS Performance Standard C

<b>Cat.# 31153: QuEChERS Performance Standard A (16 components)</b>	Dimethoate (60-51-5) Fenthion (55-38-9) Malathion (121-75-5) Methamidophos (10265-92-6) Mevinphos (7786-34-7) Omethoate (1113-02-6) Phosalone (2310-17-0) Pirimiphos methyl (29232-93-7) Propargite (2312-35-8)	<b>Cat.# 31154: QuEChERS Performance Standard B (7 components)</b>	gamma-BHC (Lindane) (58-89-9) Chlorothalonil (1897-45-6) 4,4'-DDT (50-29-3) Dicofol (Kelthane) (115-32-2) Endosulfan sulfate (1031-07-8) Endrin (72-20-8) 2-Phenylphenol (90-43-7)	<b>Cat.# 31155: QuEChERS Performance Standard C (17 components)</b>	Folpet (133-07-3) Imazalil (35554-44-0) Iprodione (36734-19-7) Metalaxyl (57837-19-1) Methiocarb (2032-65-7) Myclobutanil (88671-89-0) cis-Permethrin (61949-76-6) trans-Permethrin (61949-77-7) Thiabendazole (148-79-8) Vinclozolin (50471-44-8)
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Description	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
QuEChERS Performance Standards Kit	300 µg/mL each in acetonitrile:acetic acid (99.9:0.1), 1 mL/ampul. Blend equal volumes of all three ampuls for a 100 µg/mL final solution.	Yes	3 months	Ambient	10 °C or colder	kit	31152

*Continued*



**QuEChERS Internal Standard Mix for GC-MS Analysis**

(6 components)

PCB 18 (37680-65-2), 50 µg/mL  
 PCB 28 (7012-37-5), 50 µg/mL  
 PCB 52 (35693-99-3), 50 µg/mL  
 Triphenylmethane (519-73-3), 10 µg/mL

Triphenylphosphate (115-86-6), 20 µg/mL  
 Tris(1,3-dichloroisopropyl)phosphate (13674-87-8), 50 µg/mL

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Internal Standard Mix for GC/MS Analysis</b>							
In acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33267

*Continued*

**QuEChERS Internal Standard Mix for GC-NPD and LC-MS/MS Analysis**

(2 components)

Triphenylphosphate (115-86-6), 20 µg/mL  
 Tris(1,3-dichloroisopropyl)phosphate (13674-87-8), 50 µg/mL

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
<b>QuEChERS Internal Standard Mix for GC/NPD and LC/MS/MS Analysis</b>							
In acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33266

*Continued*

**QuEChERS Quality Control Standards for GC-MS Analysis**

PCB 138 (35065-28-2)  
 PCB 153 (35065-27-1)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
50 µg/mL each in acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33268

*Continued*

Anthracene (120-12-7)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
100 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	71 months	Ambient	10 °C or colder	ea.	33264
1000 µg/mL in acetone, 1 mL/ampul	Yes	6 months	36 months	Ambient	25 °C nominal	ea.	31269

**AOAC QuEChERS Triphenylphosphate Solution**

Triphenylphosphate (115-86-6)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
2 µg/mL in acetonitrile:acetic acid (99:1), 5 mL/ampul	Yes	6 months	36 months	Ambient	10 °C or colder	ea.	31964

**AOAC QuEChERS QC Spike Mix**

(27 components)

Atrazine (1912-24-9)	Chlorpyrifos methyl (5598-13-0)	Ethion (563-12-2)	Methomyl (16752-77-5)	Thiabendazole (148-79-8)
Azoxystrobin (131860-33-8)	lambda-Cyhalothrin (91465-08-6)	Imazalil (35554-44-0)	cis-Permethrin (61949-76-6)	Tolyfluanid (731-27-1)
Bifenthrin (82657-04-3)	Cyprodinil (121552-61-2)	Imidacloprid (138261-41-3)	trans-Permethrin (61949-77-7)	Trifluralin (1582-09-8)
Carbaryl (Sevin) (63-25-2)	2,4'-DDD (53-19-0)	Kresoxim methyl (143390-89-0)	Procymidone (32809-16-8)	
Chlorothalonil (1897-45-6)	Dichlorvos (DDVP) (62-73-7)	Linuron (330-55-2)	Pymetrozine (123312-89-0)	
Chlorpyrifos (2921-88-2)	Endosulfan sulfate (1031-07-8)	Methamidophos (10265-92-6)	Tebuconazole (107534-96-3)	

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
40 µg/mL each in acetonitrile:acetic acid (99.9:0.1), 5 mL/ampul	Yes	3 months	12 months	Ambient	10 °C or colder	ea.	31999

*Continued*

**AOAC QuEChERS IS Solution**

(2 components)

α-BHC-d6 (α-HCH-d6) (86194-41-4)  
 Parathion-d10 (350820-04-1)

Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
40 µg/mL each in acetonitrile, 5 mL/ampul	Yes	6 months	18 months	Ambient	10 °C or colder	ea.	31963

*Continued*

QuEChERS Single-Component Reference Standards

2,2',3,4,4',5'-Hexachlorobiphenyl (BZ #138)

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ #138)	35065-28-2	10 µg/mL in isooctane, 1 mL/ampul	Yes	6 months	75 months	Ambient	25 °C nominal	ea.	32286
PCB 138	35065-28-2	50 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33262

2,2',4,4',5,5'-Hexachlorobiphenyl (BZ #153)

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
PCB 153	35065-27-1	50 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33263

Continued

2,2',5,5'-Tetrachlorobiphenyl (BZ #52)

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
2,2',5,5'-Tetrachlorobiphenyl (BZ #52)	35693-99-3	10 µg/mL in isooctane, 1 mL/ampul	Yes	6 months	75 months	Ambient	25 °C nominal	ea.	32284
PCB 52	35693-99-3	50 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33257

Continued

2,4,4'-Trichlorobiphenyl (BZ #28)

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
PCB 28	7012-37-5	50 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	75 months	Ambient	10 °C or colder	ea.	33256

Continued

Triphenylphosphate

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
Triphenylphosphate	115-86-6	20 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	71 months	Ambient	10 °C or colder	ea.	33258
	115-86-6	1000 µg/mL in acetone, 1 mL/ampul	Yes	6 months	71 months	Ambient	10 °C or colder	ea.	33281

Continued

Tris(1,3-dichloroisopropyl)phosphate

Description	CAS #	Conc. in Solvent	CRM?	Min Shelf Life on Ship Date	Max Shelf Life on Ship Date	Shipping Conditions	Storage Temp.	qty.	cat.#
Tris(1,3-dichloroisopropyl)phosphate	13674-87-8	50 µg/mL in acetonitrile, 5 mL/ampul	Yes	6 months	84 months	Ambient	10 °C or colder	ea.	33259

Continued

Continued

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**Switzerland** BGB Analytik AG • Rohrmattstrasse 4 • 4461 Böckten • Phone +41 61 991 00 46 • Fax +41 61 991 00 25 • [sales@bgb-analytik.com](mailto:sales@bgb-analytik.com)

**Austria** BGB Analytik Vertrieb GmbH • Mühlestraße 1 • 79539 Lörrach • Phone +49 7621 5884270 • Fax +49 7621 5884289 • [sales.de@bgb-analytik.com](mailto:sales.de@bgb-analytik.com)

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