Q-sep™ innovative chromatography solutions

QuEChERS Products

Fast, Simple Sample Prep for Multi-Residue Pesticide Analysis

RESTEK EXCLUSIVE:
Save time with new standards—
ready to use, no dilution necessary!

- Speed up sample throughput—4-fold faster than modified Luke methods.
- Reduce solvent usage up to 9-fold, with no chlorinated waste.
- Simultaneously generate samples for GC/MS and LC/MS/MS.

RESTEK Chromatography Products www.restek.com

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ECHnology Pty Ltd
Australian Distributors; Importers & Manufacturers

Save Time and Money with QuEChERS

- Ready-to-use extraction and dSPE tubes, no glassware required.
- Preweighed adsorbents for dSPE cleanup.
- Convenient, method-specific internal and QC standards.

Quick, Easy, Cheap, Effective, Rugged, and Safe, the QuEChERS ("catchers") method is a fast, simple, and effective alternative to conventional sample prep for multiresidue pesticide analysis. QuEChERS is based on work done by the US Department of Agriculture Eastern Regional Research Center in Wyndmoor, PA.[1] Researchers there were looking for a simple, effective, and inexpensive way to extract and clean pesticide residues from the many varied sample matrices that they worked with routinely. They had been using the modified Luke extraction method, which is highly effective and rugged, but is solvent, labor, and glassware intensive, leading to a relatively high cost per sample. In contrast, QuEChERS employs a very short shake-extraction step, making it faster and less labor intensive. Solid phase extraction cleanup of extracts from other methods also had been effective, but the complex matrices the investigators were dealing with required multiple individual cartridges to remove the many classes of interferences, which added significant cost and complexity to the process. To reduce costs and speed up sample preparation, they developed a novel dispersive solid phase extraction (dSPE) technique, which effectively removes sugars, lipids, organic acids, sterols, proteins, pigments and excess water, but is far simpler and less expensive than conventional methods (Table I).

Using QuEChERS, samples are prepared in 3 simple steps. As shown on the following page, samples are first homogenized, then extracted and partitioned with an organic solvent and salt solution, with the extracts finally cleaned using the dSPE technique. Using the dSPE approach, the quantity and type of sorbents, can easily be optimized for different matrix interferences and difficult analytes. Results from this approach have been verified and modified at several USDA and Food and Drug Administration labs, and the method now is widely accepted for many types of pesticide residue samples. Validation and proficiency data for the QuEChERS method are available for a wide variety of pesticides in several common food matrices at **www.quechers.com.**

Restek Q-sep™ products make QuEChERS even simpler. All extraction salts, adsorbents, and sample tubes are included—no specialized equipment or glassware is required. The dSPE centrifuge tube format, available in 2mL and 15mL sizes, contains magnesium sulfate (to partition water from organic solvent) and PSA adsorbent (to remove sugars and fatty acids), with or without graphitized carbon (to remove pigments and sterols) or C18 (to remove nonpolar interferences). Custom products are available by request. If you are frustrated with the time and expense of your current pesticide sample cleanup procedure, we suggest you try this simple, economical new method.

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 200mL, quartz wool, funnel, water bath or evaporator	none	Ready-to-use

Try QuEChERS risk-free today!

Call 800-356-1688 to request a free sample pack of Q-sep™ QuEChERS tubes.

Prepare Samples for LC or GC Analysis in 3 Simple Steps

1. Blend

Homogenize the sample.

2. Extract and Dry

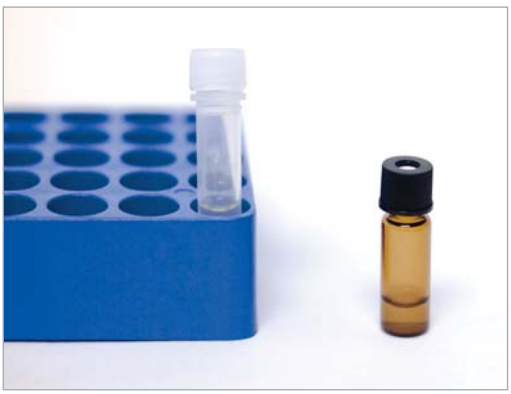
Add acetonitrile and internal standard, then shake vigorously for 1 minute.

Add buffering salts and shake, then centrifuge for 5 minutes to separate the phases.

3. Clean Up

Transfer supernatant to dSPE tube.

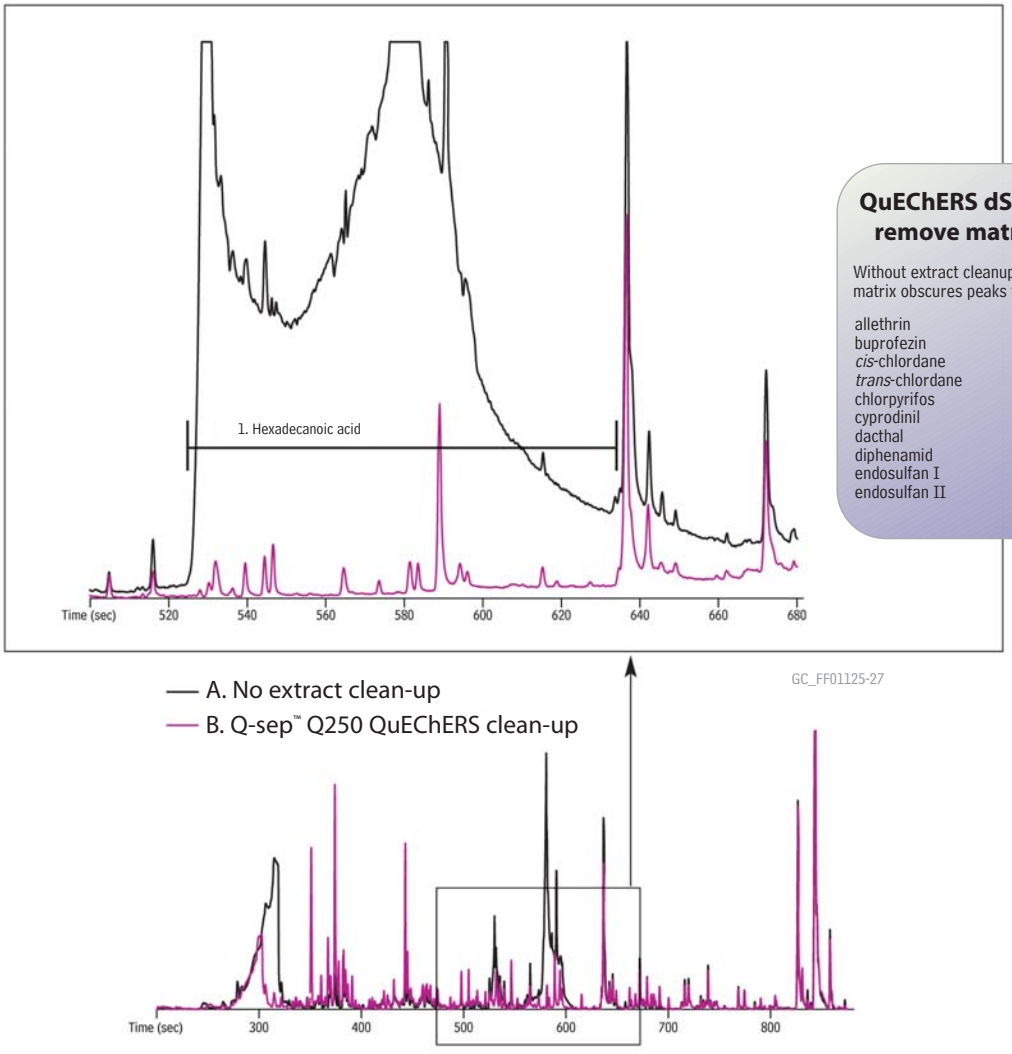
Shake, centrifuge, and transfer to an autosampler vial for analysis by GC or LC.



QuEChERS dSPE Cleanup Assures Optimal Results for Pesticide Analysis

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

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



QuEChERS dSPE sorbents easily remove matrix interferences.

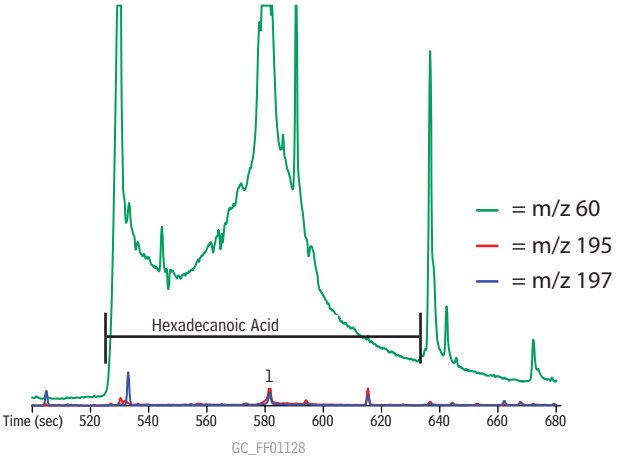
Without extract cleanup, hexadecanoic acid from the matrix obscures peaks for all the following pesticides.

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

Column:	Rxi®-5Sil MS, 20m, 0.18mm ID, 0.18µm (cat.# 43602)
Sample:	sweet potato spiked with pesticide mix, extracted with acetonitrile and Q-sep™ Q110 QuEChERS extraction tube (cat.# 26213) A. extract (without clean-up step) acidified with formic acid to pH 5 B. extract with clean-up using Q-sep™ Q250 QuEChERS dSPE clean-up tube (cat.# 26124), acidified with formic acid to pH 5
Inj.:	1.0µL splitless (hold 1 min.), 4mm single gooseneck liner with w/wool (cat.# 22405)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	72.5°C (hold 1 min.) to 350°C @ 20°C/min.
Det:	TOFMS
MS source temp.:	225°C
Scan range:	45-550, m/z 60, 73, 87, 129, 256 plotted
Ionization:	EI
Instrument:	Agilent 6890 GC, LECO Pegasus III TOFMS

Figure 2 QuEChERS dSPE cleanup significantly improves quantification and identification.

Without cleanup, matrix masks Endosulfan I.



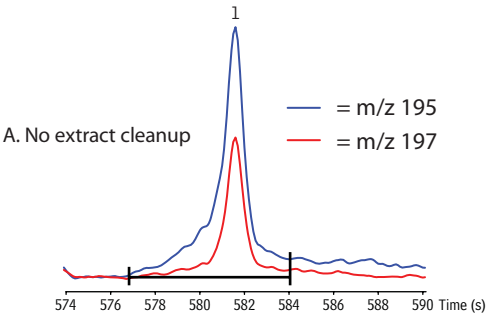
GC_FF01128

Peak List
1. endosulfan I

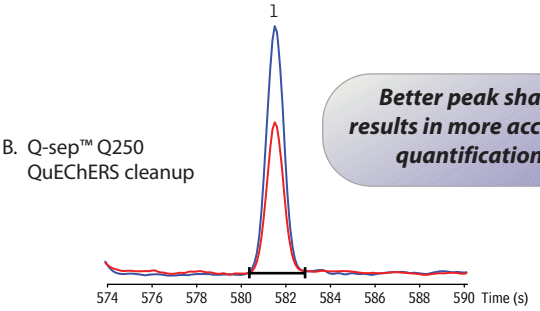
Column:	Rxi®-5Sil MS, 20m, 0.18mm ID, 0.18µm (cat.# 43602)
Sample:	sweet potato spiked with pesticide mix, extracted with acetonitrile and Q-sep™ Q110 QuEChERS extraction tube (cat.# 26213), then acidified with formic acid to pH 5
Inj.:	1.0µL splitless (hold 1 min.), 4mm single gooseneck liner with w/wool (cat.# 22405)
Inj. temp.:	250°C
Carrier gas:	helium, constant flow
Flow rate:	1.2mL/min.
Oven temp.:	72.5°C (hold 1 min.) to 350°C @ 20°C/min.
Det:	TOFMS
Source temp.:	225°C
Scan range:	45-550, m/z 60, 195, 197 plotted
Ionization:	EI
Instrument:	Agilent 6890 GC, LECO Pegasus III TOFMS

QuEChERS dSPE cleanup improves quantification and identification.

Peak Integration (extracted ion chromatograms)



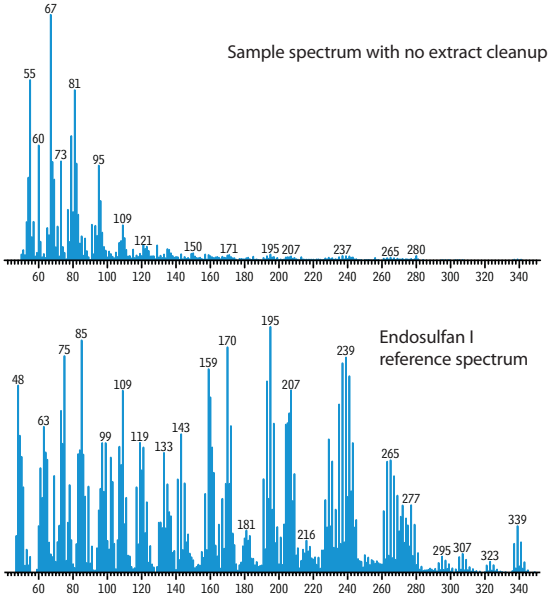
GC_FF01133

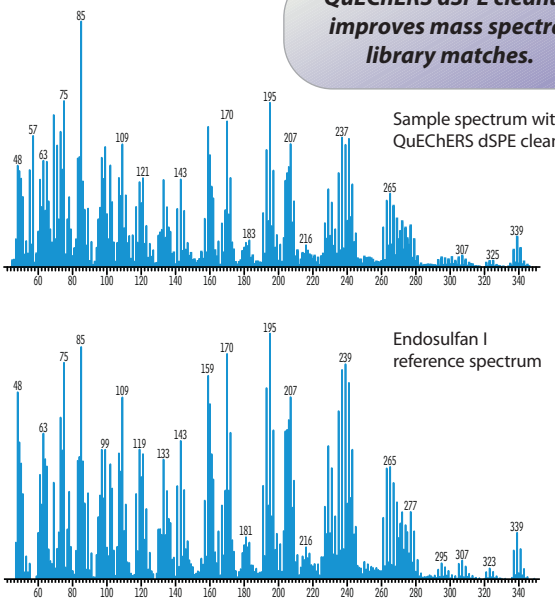


GC_FF01134

Better peak shape results in more accurate quantification.

Spectral Identification





QuEChERS dSPE cleanup improves mass spectral library matches.

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 50mg 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 the AOAC methods.

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

Rt (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	*o*-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	*cis*-permethrin	52645-53-1	insecticide	pyrethroid	106	65
21.47	*trans*-permethrin	51877-74-8	insecticide	pyrethroid	109	71
23.74	deltamethrin	52918-63-5	insecticide	pyrethroid	97	52

*50mg PSA, 50mg C18, **50mg PSA, 50mg GCB

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

Strawberry extracts were spiked at 200ng/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.

Sorbent Guide

Sorbent	Removes
PSA*	sugars, fatty acids, organic acids, anthocyanine pigments
C18	lipids, nonpolar interferences
GCB**	pigments, sterols, nonpolar interferences

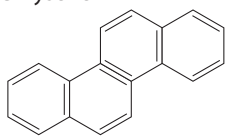
*PSA—primary and secondary amine exchange material
**GCB—graphitized carbon black

Example dSPE Cleanup: PAHs in Infant Formula

Analyzing polycyclic aromatic hydrocarbons (PAHs) in infant formula can be difficult as both the target analytes and certain matrix elements are lipophilic in nature and difficult to separate. Proper sorbent choice is critical to removing matrix interferences, while assuring good PAH recoveries. When choosing a sorbent, target analyte and matrix component chemistry must be considered. PAHs are relatively nonpolar, planar compounds with no pH-dependent functional groups. Infant formula typically contains significant amount of sugars and can be fortified with fatty acids.

Here, PSA was chosen for dSPE cleanup since both sugars and fatty acids can be removed through hydrogen bonding. Using PSA to remove these matrix compounds is optimal, because it will not bind to the relatively nonpolar PAHs, thus ensuring they remain available for analysis. C18 should not be used here because lipophilic PAHs could also be removed. Similarly, GCB is not recommended, because it also can bind planar PAHs. (Note: GCB is not needed since infant formula does not contain pigments.) Based on the chemical structure of the analytes of interest, as well as the most dominant matrix compounds, PSA is the best choice when analyzing PAHs in infant formula.

Chrysene



Phenanthrene

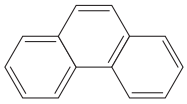
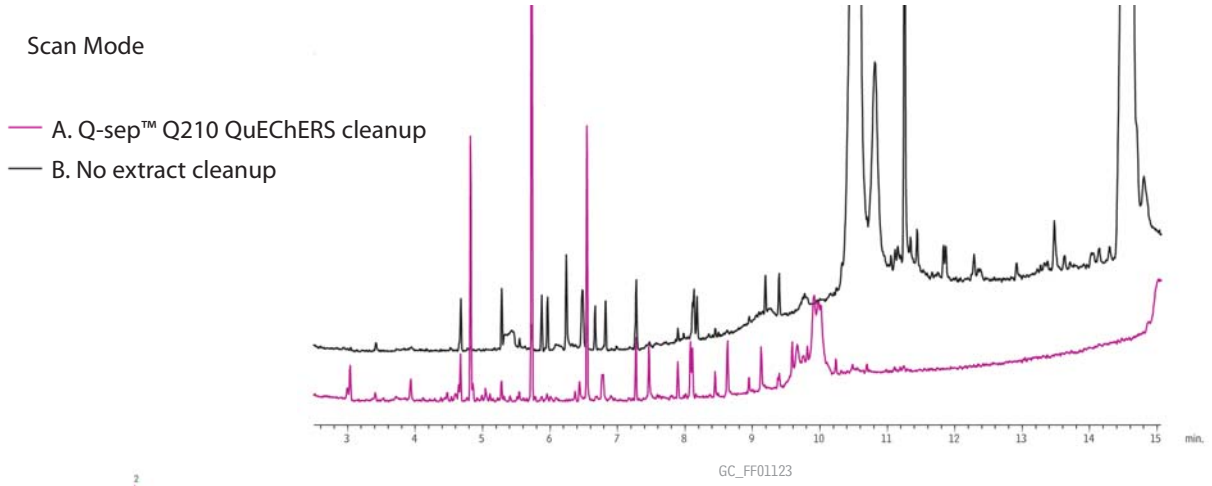
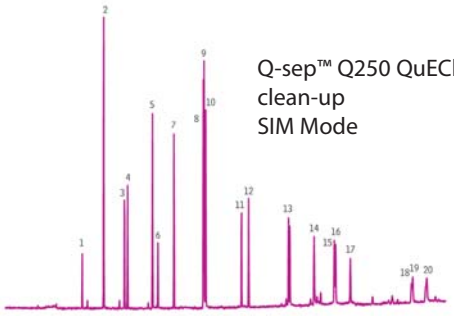


Figure 3 PSA is ideal for removing matrix sugars and fatty acids while leaving PAHs behind for analysis.





Compound list and ions monitored (SIM mode)

Compound	m/z
1. decafluorobiphenyl (SS)	265
2. naphthalene	128
3. 2-methylnaphthalene	142
4. 1-methylnaphthalene	142
5. acenaphthylene	152
6. acenaphthene	152
7. fluorene	166
8. phenanthrene-d10 (IS)	188
9. phenanthrene	178
10. anthracene	178
11. fluoranthene	202
12. pyrene	202
13. benzo(a)anthracene	228
14. chrysene	228
15. benzo(b)fluoranthene	252
16. benzo(k)fluoranthene	252
17. benzo(a)pyrene	252
18. indeno(1,2,3-cd)pyrene	276
19. dibenzo(a,h)anthracene	278
20. benzo(ghi)perylene	276

Column:	Rxi®-5Sil MS, 30m, 0.25mm ID, 0.25µm (cat.# 13623)
Sample:	liquid infant formula spiked at 1µg/mL with decafluorobiphenyl (cat.# 31842) and EPA Method 8310 PAH Mixture (cat.# 31841) and at 0.5µg/mL with internal standard phenanthrene-d10 (cat.# 31045), then extracted with acetonitrile and Q-sep™ Q110 QuEChERS extraction tube (cat.# 26213) A. extract with clean-up using Q-sep™ Q210 QuEChERS dSPE clean-up tube (cat.# 26215) B. extract without clean-up
Inj.:	1.0µL splitless (hold 0.15 min.), 3.5mm single gooseneck liner with w/wool (cat.# 22286-200.1)
Inj. temp.:	300°C
Carrier gas:	helium, constant flow
Flow rate:	1.4mL/min.
Oven temp.:	50°C (hold 0.5 min.) to 290°C @ 25°C/min. to 320°C @ 5°C/min. (hold 5 min.)
Det:	quadrupole MS
Transfer line temp.:	290°C
Scan range:	100-350amu
Ionization:	EI
Mode:	scan (SIM)
Instrument:	Shimadzu GCMS-QP2010 Plus

QuEChERS Methods for Complex and Varied Matrices

QuEChERS has been successfully applied to many different types of matrices. When developing procedures for your lab, start with these selected references—or visit **www.restek.com/quechers** for an expanded version that includes hyperlinks. (Note: references not available from Restek.)

General/Original

1. Fast and Easy Multiresidue Method Employing Acetonitrile Extraction/Partitioning and "Dispersive Solid-Phase Extraction" for the Determination of Pesticide Residues in Produce. (M. Anastassiades, S.J. Lehotay, D. Stajnbaher, F.J. Schenck, J. AOAC International 86 (2003) 412.)
2. QuEChERS—A Mini-Multiresidue Method for the Analysis of Pesticide Residues in Low-Fat Products. (http://www.quechers.com (accessed July 15, 2008).)
3. Pesticide Residues in Foods by Acetonitrile Extraction and Partitioning with Magnesium Sulfate. (AOAC Official Method 2007.01.)
4. Foods of Plant Origin—Determination of Pesticide Residues Using GC-MS and/or LC-MS/MS Following Acetonitrile Extraction/Partitioning and Clean-up by Dispersive SPE (QuEChERS-method). (EN 15662 Version 2008.)
5. Matrix Effects in Pesticide Multi-Residue Analysis by Liquid Chromatography-Mass Spectrometry. (A. Kruve, A. Künnapas, K. Herodes, I. Leito, J. Chromatogr. A 1187 (2008) 58.)
6. Use of Automated Direct Sample Introduction with Analyte Protectants in the GC-MS Analysis of Pesticide Residues. (T. Cajka, K. Mastovská, S.J. Lehotay, J. Hajslová, J. Sep. Sci. 28 (2005) 1048.)

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7. Validation of a Fast and Easy Method for the Determination of Residues from 229 Pesticides in Fruits and Vegetables Using Gas and Liquid Chromatography and Mass Spectrometric Detection. (S.J. Lehotay, A. de Kok, M. Hiemstra, P. Van Bodegraven, J. AOAC Int. 88 (2005) 595.)
8. Determination of Pesticide Residues in Foods by Acetonitrile Extraction and Partitioning with Magnesium Sulfate: Collaborative Study. (S.J. Lehotay, J. AOAC Int. 90 (2007) 485.
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10. Multiresidue Analysis of 102 Organophosphorus Pesticides in Produce at Parts-Per-Billion Levels Using a Modified QuEChERS Method and Gas Chromatography with Pulsed Flame Photometric Detection. (F. Schenck, J. Wong, C. Lu, J. Li, J.R. Holcomb, L.M. Mitchell, J. AOAC Int. 92 (2009) 561.)
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12. Evaluation of the QuEChERS Sample Preparation Approach for the Analysis of Pesticide Residues in Olives. (S.C. Cunha, S.J. Lehotay, K. Mastovska, J.O. Fernandes, M. Beatriz, P.P. Oliveira, J. Sep. Sci. 30 (2007) 620.)
13. Evaluation of two Fast and Easy Methods for Pesticide Residue Analysis in Fatty Food Matrixes. (S.J. Lehotay, K. Mastovská, S.J. Yun, J. AOAC Int. 88 (2005) 630.)
14. Multi-Residue Determination of Veterinary Drugs in Milk by Ultra-High-Pressure Liquid Chromatography-Tandem Mass Spectrometry. (M.M. Aguilera-Luiz, J.L. Vidal, R. Romero-González, A.G. Frenich, J. Chromatogr. A 1205 (2008) 10.)
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16. Dispersive Solid-Phase Extraction Followed by Liquid Chromatography-Tandem Mass Spectrometry for the Multi-Residue Analysis of Pesticides in Raw Bovine Milk. (T. Dagnac, M. Garcia-Chao, P. Pulleiro, C. Garcia-Jares, M. Llompart, J. Chromatogr. A 1216 (2009) 3702.)

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17. Comparison of an Acetonitrile Extraction/Partitioning and "Dispersive Solid-Phase Extraction" Method with Classical Multi-Residue Methods for the Extraction of Herbicide Residues in Barley Samples. (C. Díez, W.A. Traag, P. Zommer, P. Marinero, J. Atienza, J. Chromatogr. A 1131 (2006) 11.)

18. A Multi-Residue Method for the Determination of 203 Pesticides in Rice Paddies Using Gas Chromatography/Mass Spectrometry. (T.D. Nguyen, E.M. Han, M.S. Seo, S.R. Kim, M.Y. Yun, D.M. Lee, G.H Lee, Anal. Chim. Acta 619 (2008) 67.)

19. Development of a Multi-Residue Method for the Determination of Pesticides in Cereals and Dry Animal Feed Using Gas Chromatography-Tandem Quadrupole Mass Spectrometry II. Improvement and Extension to New Analytes. (S. Walorczyk, J. Chromatogr. A 1208 (2008) 202.)

Oils

20. Multiresidue Analytical Method of Pesticides in Peanut Oil Using Low-Temperature Cleanup and Dispersive Solid Phase Extraction by GC-MS. (L. Li, H. Zhang, C. Pan, Z. Zhou, S. Jiang, F. Liu, J. Sep. Sci. 30 (2007) 2097.)

21. Simplified Pesticide Multiresidue Analysis of Soybean Oil by Low-Temperature Cleanup and Dispersive Solid-Phase Extraction Coupled with Gas Chromatography/Mass Spectrometry. (L. Li, Y. Xu, C. Pan, Z. Zhou, S. Jianc, F. Liu, J. AOAC Int. 90 (2007) 1387.)

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22. Determination of 142 Pesticides in Fruit- and Vegetable-Based Infant Foods by Liquid Chromatography/Electrospray Ionization-Tandem Mass Spectrometry and Estimation of Measurement Uncertainty. (J. Wang, D. Leung, J. AOAC Int. 92 (2009) 279.)

23. Method for Routine Screening of Pesticides and Metabolites in Meat Based Baby-Food Using Extraction and Gas Chromatography-Mass Spectrometry. (C. Przybylski, C. Segard, J. Sep. Sci. 32 (2009) 1858.)

24. Determination of Priority Pesticides in Baby Foods by Gas Chromatography Tandem Quadrupole Mass Spectrometry. (C.C. Leandro, R.J. Fussell, B.J. Keely, J. Chromatogr. A 1085 (2005) 207.)

Non-Food Matrices

25. Multiresidue Analytical Method Using Dispersive Solid-Phase Extraction and Gas Chromatography/Ion Trap Mass Spectrometry to Determine Pharmaceuticals in Whole Blood. (F. Plössl, M. Giera, F. Bracher, J. Chromatogr. A 1135 (2006) 19.)

26. Comparison of Four Extraction Methods for the Analysis of 24 Pesticides in Soil Samples with Gas Chromatography-Mass Spectrometry and Liquid Chromatography-Ion Trap-Mass Spectrometry. (C. Lesueur, M. Gartner, A. Mentler, M. Fuerhacker, Talanta 75 (2008) 284.)

27. Comparative Study of Pesticide Multi-Residue Extraction in Tobacco for Gas Chromatography-Triple Quadrupole Mass Spectrometry. (J.M. Lee, J.W. Park, G.C. Jang, K.J. Hwang, J. Chromatogr. A 1187 (2008) 25.)

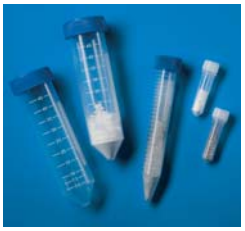
Muscle and Tissues

28. Dispersive Solid-Phase Extraction for the Determination of Sulfonamides in Chicken Muscle by Liquid Chromatography. (A. Posyniak, J. Zmudzki, K. Mitrowska, J. Chromatogr. A 1087 (2005) 259.)

29. Confirmatory and Quantitative Analysis of Beta-Lactam Antibiotics in Bovine Kidney Tissue by Dispersive Solid-Phase Extraction and Liquid Chromatography-Tandem Mass Spectrometry. (C.K. Fagerquist, A.R. Lightfield, S.J. Lehotay, Anal. Chem. 77 (2005) 1473.)

30. The Development and Validation of a Multiclass Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS) Procedure for the Determination of Veterinary Drug Residues in Animal Tissue Using a QuEChERS (QUick, Easy, CHeap, Effective, Rugged and Safe) Approach. (G. Stubbings, T. Bigwood, Anal. Chim. Acta 637 (2009) 68.)

Q-sep™ QuEChERS Sample Prep Tubes



Description	Material	Methods	qty.	cat#
50mL Centrifuge Tubes for Sample Extraction				
Q110	4g $MgSO_4$, 1g NaCl, 1g trisodium citrate dihydrate, 0.5g disodium hydrogencitrate sesquihydrate	Mini-Multiresidue, European EN-15662	50-pk.	26213
Q150	6g $MgSO_4$, 1.5g NaOAc	AOAC 2007.1	50-pk.	26214
Empty 50mL Centrifuge Tube	—	Mini-Multiresidue, European EN-15662, AOAC 2007.1	25-pk.	26227
2mL Micro-Centrifuge Tubes for dSPE (clean-up of 1mL extract)				
Q210	150mg $MgSO_4$, 25mg PSA	Mini-Multiresidue, European EN-15662	100-pk.	26215
Q211	150mg $MgSO_4$, 25mg PSA, 25mg C18	Mini-Multiresidue	100-pk.	26216
Q212	150mg $MgSO_4$, 25mg PSA, 2.5mg GCB	Mini-Multiresidue, European EN-15662	100-pk.	26217
Q213	150mg $MgSO_4$, 25mg PSA, 7.5mg GCB	Mini-Multiresidue, European EN-15662	100-pk.	26218
Q250	150mg $MgSO_4$, 50mg PSA	AOAC 2007.1	100-pk.	26124
Q251	150mg $MgSO_4$, 50mg PSA, 50mg C18	AOAC 2007.1	100-pk.	26125
Q253	150mg $MgSO_4$, 50mg PSA, 50mg GCB	—	100-pk.	26123
Q252	150mg $MgSO_4$, 50mg PSA, 50mg C18, 50mg GCB	AOAC 2007.1	100-pk.	26219
15mL Centrifuge Tubes for dSPE (clean-up of 6mL extract)				
Q350	1200mg $MgSO_4$, 400mg PSA	AOAC 2007.1	50-pk.	26220
Q351	1200mg $MgSO_4$, 400mg PSA, 400mg C18	AOAC 2007.1	50-pk.	26221
Q352	1200mg $MgSO_4$, 400mg PSA, 400mg C18, 400mg GCB	AOAC 2007.1	50-pk.	26222
Q370	900mg $MgSO_4$, 150mg PSA	European EN-15662	50-pk.	26223
Q371	900mg $MgSO_4$, 150mg PSA, 15mg GCB	European EN-15662	50-pk.	26224
Q372	900mg $MgSO_4$, 150mg PSA, 45mg GCB	European EN-15662	50-pk.	26225
Q373	900mg $MgSO_4$, 150mg PSA, 150mg C18	—	50-pk.	26226
Q374	900mg $MgSO_4$, 300mg PSA, 150mg GCB	—	50-pk.	26126

PSA—primary and secondary amine exchange material
GCB—graphitized carbon black

Sorbent Guide

Sorbent	Removes
PSA*	sugars, fatty acids, organic acids, anthocyanine pigments
C18	lipids, nonpolar interferences
GCB**	pigments, sterols, nonpolar interferences

*PSA—primary and secondary amine exchange material
**GCB—graphitized carbon black

Try QuEChERS risk-free today!

Call 800-356-1688 to request a free sample pack of Q-sep™ QuEChERS tubes.

(Sample pack orders cannot be placed on line. Limit one pack per customer.)

GC and HPLC Columns

Rxi®-5Sil MS (low polarity Crossbond® silarylene phase; selectivity close to 5% diphenyl/95% dimethyl polysiloxane)

- Engineered to be a low bleed GC/MS column.
- Excellent inertness for active pesticides and other compounds.
- Temperature range: -60°C to 350°C.

The Rxi®-5Sil MS stationary phase incorporates phenyl groups in the polymer backbone. This improves thermal stability, reduces bleed, and makes the phase less prone to oxidation. Rxi®-5Sil MS columns are ideal for GC/MS applications requiring high sensitivity, including use in ion trap and TOFMS systems.

Rxi®-5Sil MS Columns (fused silica)

(Crossbond®, selectivity close to 5% diphenyl/95% dimethyl polysiloxane)

ID	df (µm)	temp. limits	30-Meter
	0.25	-60 to 330/350°C	13623
	0.50	-60 to 330/350°C	13638

ID	df (µm)	temp. limits	20-Meter
0.18mm	0.18	-60 to 330/350°C	43602
	0.36	-60 to 330/350°C	43604

For guard cartridges for these HPLC columns, visit our website at **www.restek.com**.

Ultra Aqueous C18 Columns (USP L1)

Physical Characteristics:

particle size: 3µm or 5µm, spherical
pore size: 100Å
carbon load: 15%
endcap: no
pH range: 2.5 to 7.5
temperature limit: 80°C

Chromatographic Properties:

Highly retentive and selective for reversed phase separations of polar analytes. Highly base-deactivated. Compatible with highly aqueous (up to 100%) mobile phases.

Length	1.0mm ID cat.#	2.1mm ID cat.#	3.2mm ID cat.#	4.6mm ID cat.#
3µm Columns				
30mm	9178331	9178332	9178333	9178335
50mm	9178351	9178352	9178353	9178355
100mm	9178311	9178312	9178313	9178315
5µm Columns				
30mm	9178531	9178532	9178533	9178535
50mm	9178551	9178552	9178553	9178555
100mm	9178511	9178512	9178513	9178515
150mm	9178561	9178562	9178563	9178565
200mm	9178521	9178522	9178523	9178525
250mm	9178571	9178572	9178573	9178575

For guard cartridges for these HPLC columns, visit our website at **www.restek.com**.

Q-sep™ QuEChERS Standards

- Ready to use for QuEChERS extractions—no dilutions necessary.
- Support for GC and HPLC with MS, MS/MS, and selective detectors.

QuEChERS Internal Standard Mix for GC/ECD Analysis

PCB 18
PCB 28
PCB 52
tris-(1,3-dichloroisopropyl) phosphate
50µg/mL each in acetonitrile, 5mL/ampul
cat. # 33265 (ea.)

QuEChERS Internal Standard Mix for GC/MS Analysis

PCB 18	50µg/mL	tris-(1,3-dichloroisopropyl) phosphate	50
PCB 28	50	triphenylmethane	10
PCB 52	50		
triphenyl phosphate	20		

In acetonitrile, 5mL/ampul
cat. # 33267 (ea.)

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

triphenyl phosphate 20µg/mL
tris-(1,3-dichloroisopropyl)phosphate 50µg/mL
In acetonitrile, 5mL/ampul
cat. # 33266 (ea.)

QuEChERS Internal Standard Mix for LC/MS/MS Analysis

nicarbazin
10µg/mL in acetonitrile, 5mL/ampul
cat. # 33261 (ea.)

QuEChERS Quality Control Standards for GC/MS Analysis

Cat.# 33268:
PCB 138
PCB 153
Cat.# 33264:
anthracene
50µg/mL each in acetonitrile, 5mL/ampul
cat. # 33268 (ea.)
100µg/mL in acetonitrile, 5mL/ampul
cat. # 33264 (ea.)

QuEChERS Single-Component Analytical Reference Materials

Concentration is µg/mL.

Compound	Solvent	Conc.	cat.# (ea.)
PCB 18 (5mL)	ACN	50	33255
PCB 28 (5mL)	ACN	50	33256
PCB 52 (5mL)	ACN	50	33257
PCB 138 (5mL)	ACN	50	33262
PCB 153 (5mL)	ACN	50	33263
triphenylmethane (5mL)	ACN	10	33260
triphenylphosphate (5mL)	ACN	20	33258
tris(1,3-dichloroisopropyl) phosphate (5mL)	ACN	50	33259

ACN=acetonitrile

Selection Guide for Q-sep™ Extraction and dSPE Tubes

Commodity types and examples	AOAC 2007.1	EN 15662	Mini-multiresidue	Additional products
 **General purpose** • Celery • Head lettuce • Cucumber • Melon	**Q-sep Q250** 2mL, 100-pk. (cat.# 26124) **Q-sep Q350** 15mL, 50-pk. (cat.# 26220)	**Q-sep Q210** 2mL, 100-pk. (cat.# 26215) **Q-sep Q370** 15mL, 50-pk. (cat.# 26223)	**Q-sep Q210** 2mL, 100-pk. (cat.# 26215)	
 **Fatty or waxy fruits & vegetables** • Cereals • Avocado • Nuts & seeds • Dairy	**Q-sep Q251** 2mL, 100-pk. (cat.# 26125) **Q-sep Q351** 15mL, 50-pk. (cat.# 26221)		**Q-sep Q211** 2mL, 100-pk. (cat.# 26216)	**Q-sep Q373** 15mL, 50-pk. (cat.# 26226)
 **Pigmented fruits & vegetables** • Strawberries • Sweet potatoes • Tomatoes	**Q-sep Q352** 15mL, 50-pk. (cat.# 26222)	**Q-sep Q212** 2mL, 100-pk. (cat.# 26217) **Q-sep Q371** 15mL, 50-pk. (cat.# 26224)	**Q-sep Q212** 2mL, 100-pk. (cat.# 26217)	**Q-sep Q253** 2mL, 100-pk. (cat.# 26123)
 **Highly pigmented fruits & vegetables** • Red peppers • Spinach • Blueberries	**Q-sep Q252** 2mL, 100-pk. (cat.# 26219)	**Q-sep Q213** 2mL, 100-pk. (cat.# 26218) **Q-sep Q372** 15mL, 50-pk. (cat.# 26225)	**Q-sep Q213** 2mL, 100-pk. (cat.# 26218)	**Q-sep Q374** 15mL, 50-pk. (cat.# 26126)
Download free instructions at **www.restek.com/quechers**	Instruction sheet# 805-01 002	Instruction sheet# 805-01 001	Instruction sheet# 805-01 001	Generic dSPE 805-01 003

Lit. Cat.# FFFL1183-INT