

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.

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.

Quick and Easy...

Prepare Samples for LC or GC Analysis in 3 Simple Steps

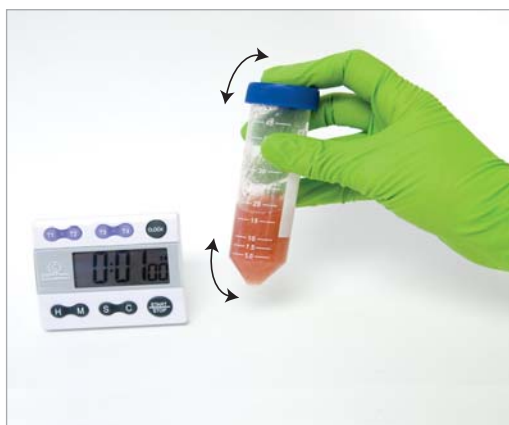
1. Blend

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.



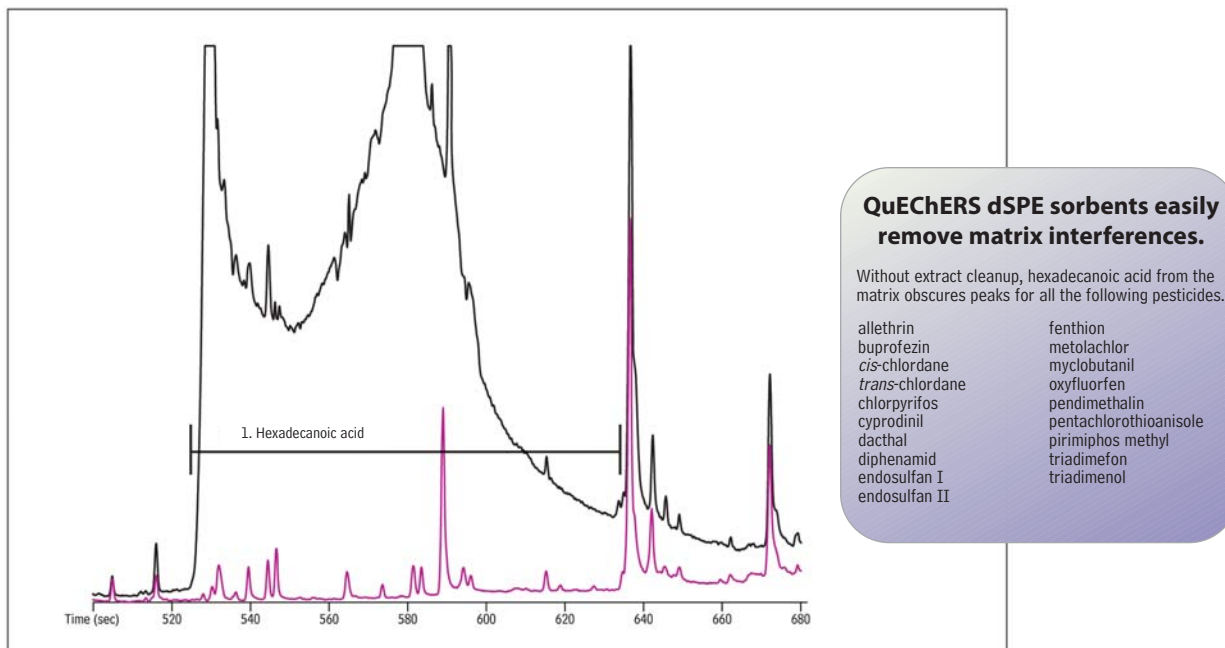
Shake, centrifuge, and transfer to an autosampler vial for analysis by GC or LC.



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 | 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 | |

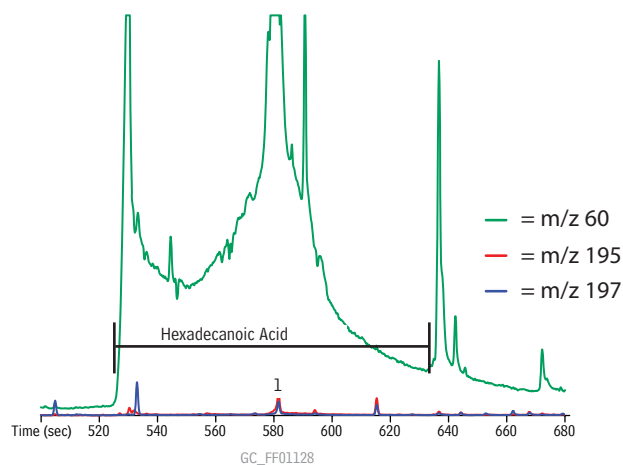
— A. No extract clean-up
 — B. Q-sep™ Q250 QuEChERS clean-up

GC_FF01125-27

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
 1.0µL splitless (hold 1 min.), 4mm single gooseneck liner with w/wool (cat.# 22405)
 Inj.:
 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.

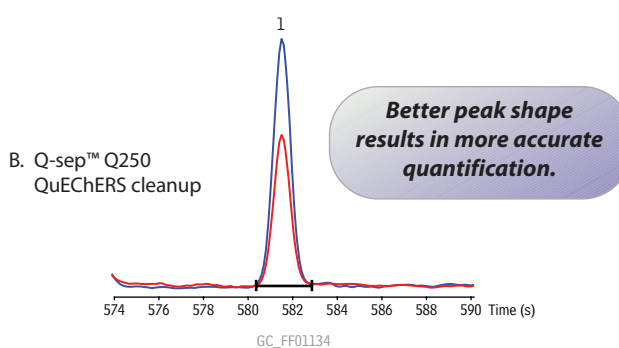
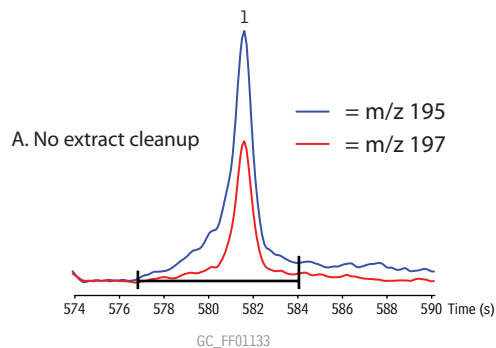


Peak List
1. endosulfan I

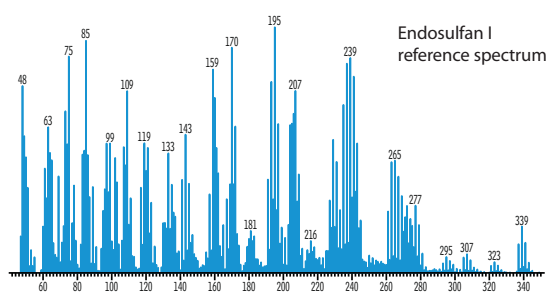
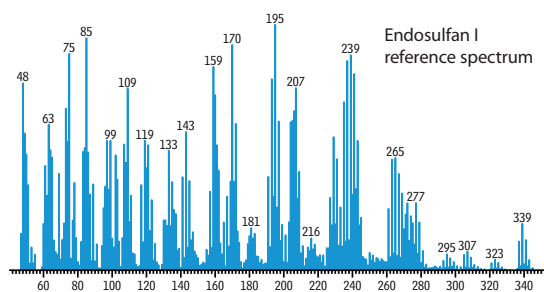
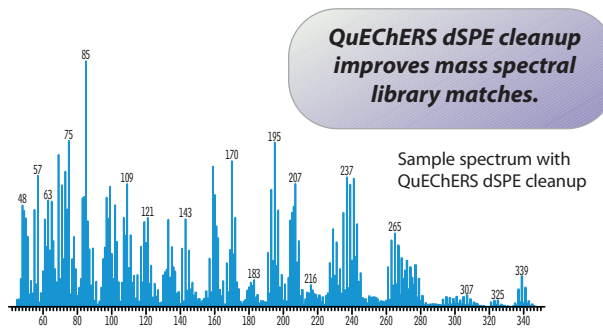
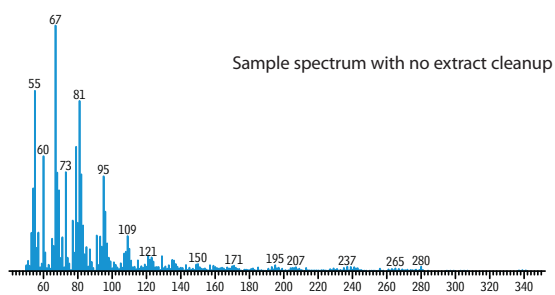
Column: Rxi®-5Sil MS, 20m, 0.18mm ID, 0.18µm (cat.# 43602)
 Sample: sweet potato spiked with pesticide mix, extracted with acetonitrile and Q-sep™ Q110 QuEChERS extraction tube (cat.# 26213), then acidified with formic acid to pH 5
 Inj.: 1.0µL splitless (hold 1 min.), 4mm single gooseneck liner with 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)



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 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 | dichlofuanid | 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 % 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



Try QuEChERS risk-free today!

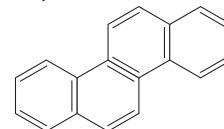
Call 800-356-1688 to request a free sample pack of Q-sep™ QuEChERS tubes.

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 non-polar, 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

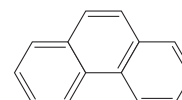
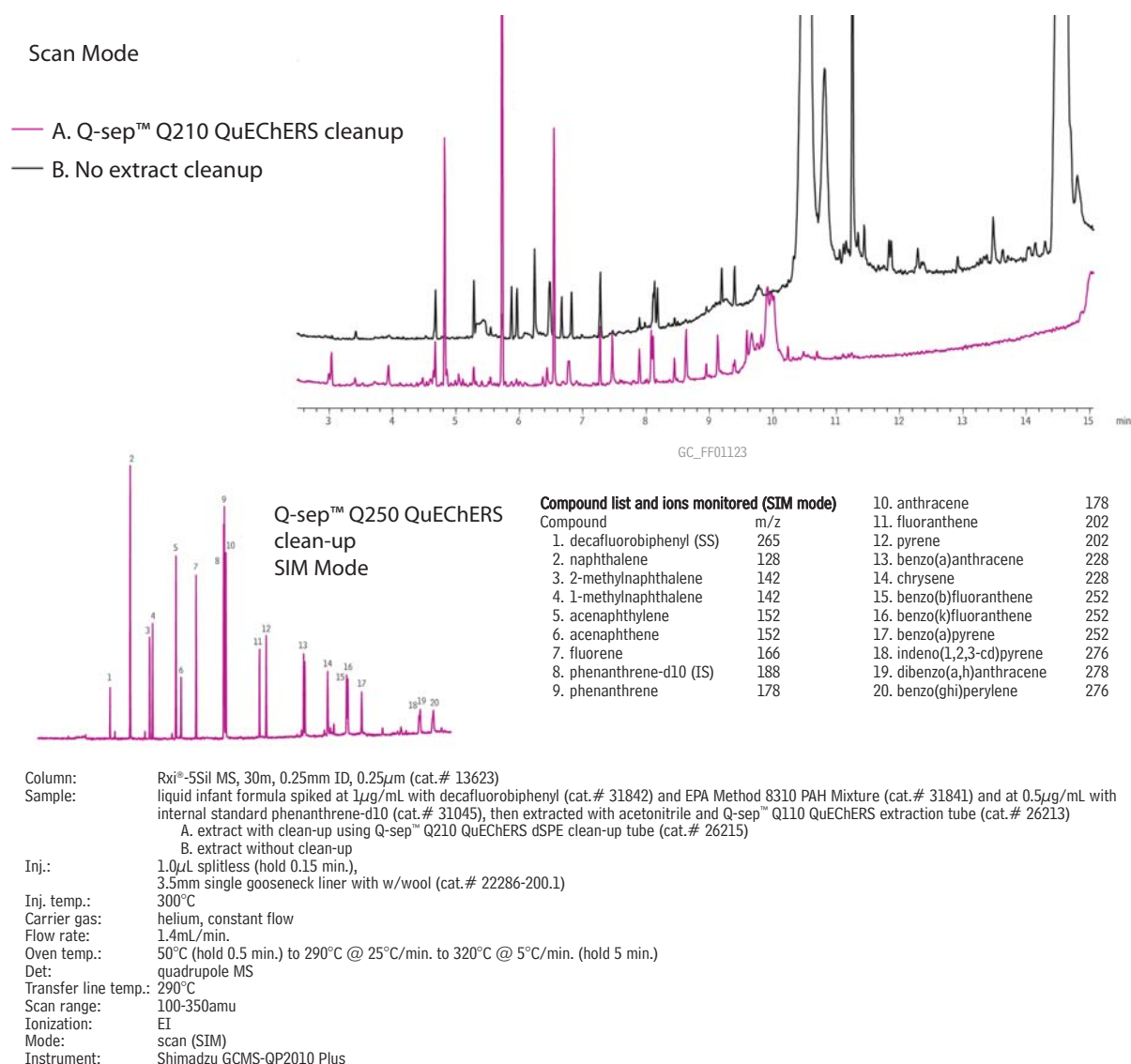


Figure 3 PSA is ideal for removing matrix sugars and fatty acids while leaving PAHs behind for analysis.



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/quenchers 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.)

General Fruits and Vegetables

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.)
9. Validation and Uncertainty Study of a Comprehensive List of 160 Pesticide Residues in Multi-Class Vegetables by Liquid Chromatography-Tandem Mass Spectrometry. (B. Kmellár, P. Fodor, L. Pareja, C. Ferrer, M.A. Martínez-Uroz, A. Valverde, A.R. Fernandez-Alba, J. Chromatogr. A 1215 (2008) 37.)
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.)
11. Multiresidue Pesticide Analysis of Wines by Dispersive Solid-Phase Extraction and Ultrahigh-Performance Liquid Chromatography-Tandem Mass Spectrometry. (K. Zhang, J.W. Wong, D.G. Hayward, P. Sheladia, A.J. Krynitsky, F.J. Schenck, M.G. Webster, J.A. Ammann, S.E. Ebeler, J. Agric. Food Chem. (2009) [published online ahead of print April 17, 2009] (accessed June 25, 2009).)

Dairy and Fatty Matrices

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.)
15. Rapid Sample Preparation Method for LC-MS/MS or GC-MS Analysis of Acrylamide in Various Food Matrices. (K. Mastovska, S.J. Lehotay, J. Agric. Food Chem. 54 (2006) 7001.)
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. Llompарт, J. Chromatogr. A 1216 (2009) 3702.)

Grains, Nuts, and Seeds

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. Janc, F. Liu, J. AOAC Int. 90 (2007) 1387.)

Baby Food

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.)



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Complete Product Offering

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 | 0.25 | -60 to 330/350°C | 13623 |
| 0.50 | 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 endcap: no
pore size: 100Å pH range: 2.5 to 7.5
carbon load: 15% 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 | | 2.1mm ID | | 3.2mm ID | | 4.6mm ID | |
|--------------------|----------|---------|----------|---------|----------|---------|----------|---------|
| | cat.# | cat.# | cat.# | cat.# | cat.# | cat.# | cat.# | cat.# |
| 3μm Columns | | | | | | | | |
| 30mm | 9178331 | 9178332 | 9178333 | 9178334 | 9178335 | 9178336 | 9178337 | 9178338 |
| 50mm | 9178351 | 9178352 | 9178353 | 9178354 | 9178355 | 9178356 | 9178357 | 9178358 |
| 100mm | 9178311 | 9178312 | 9178313 | 9178314 | 9178315 | 9178316 | 9178317 | 9178318 |
| 5μm Columns | | | | | | | | |
| 30mm | 9178531 | 9178532 | 9178533 | 9178534 | 9178535 | 9178536 | 9178537 | 9178538 |
| 50mm | 9178551 | 9178552 | 9178553 | 9178554 | 9178555 | 9178556 | 9178557 | 9178558 |
| 100mm | 9178511 | 9178512 | 9178513 | 9178514 | 9178515 | 9178516 | 9178517 | 9178518 |
| 150mm | 9178561 | 9178562 | 9178563 | 9178564 | 9178565 | 9178566 | 9178567 | 9178568 |
| 200mm | 9178521 | 9178522 | 9178523 | 9178524 | 9178525 | 9178526 | 9178527 | 9178528 |
| 250mm | 9178571 | 9178572 | 9178573 | 9178574 | 9178575 | 9178576 | 9178577 | 9178578 |

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 | | tris-(1,3-dichloroisopropyl) | |
| PCB 28 | | phosphate | |
| PCB 52 | | | |
| 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) | |
| PCB 28 | 50 | phosphate | 50 |
| PCB 52 | 50 | triphenylmethane | 10 |
| 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: | Cat. # 33264: |
| PCB 138 | anthracene |
| PCB 153 | |
| 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 |

PATENTS & TRADEMARKS

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