



# SAMPLE PREPARATION

Your Essential Resource for Supplies



The Measure of Confidence



Agilent Technologies



# QuEChERS

Agilent Bond Elut QuEChERS Kits make sample prep as easy as 1- 2- 3. Pre-packaged Agilent Bond Elut QuEChERS Kits are an easy way to capture the time-saving benefits of QuEChERS sample preparation.

- Extraction kits with pre-weighed anhydrous salts in sealed packets allow you to add salts after you add organic solvent to your sample – minimizing an exothermic reaction that can compromise analyte recovery
- Dispersive kits with sorbents and salts supplied in 2 mL or 15 mL centrifuge tubes accommodate the aliquot volumes specified by current AOAC and EN methodologies
- Universal dispersive kits provide excellent recoveries and reproducibility for all types of fruits and vegetables
- Ceramic homogenizers break up salt agglomerates, promoting consistent sample extraction and increasing product recovery during extraction and dispersion; shaking time reduced from 60 to 20 seconds

## TIPS & TOOLS

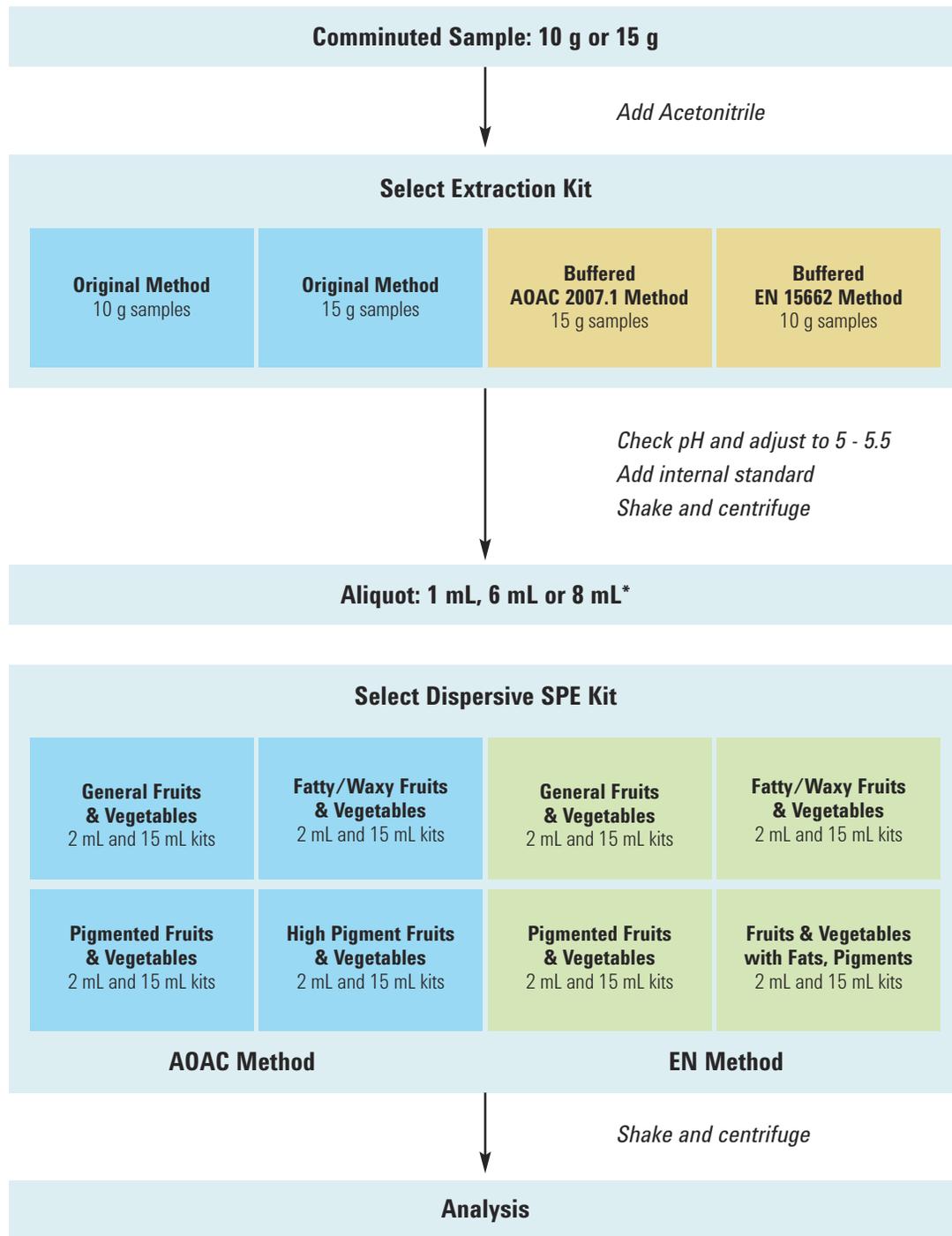


For more information on QuEChERS, please view our webinar "QuEChERS 101: The Basics and Beyond" at [www.agilent.com/chem/quetcherswebinar](http://www.agilent.com/chem/quetcherswebinar)



# Agilent Recommended Standard Operating Procedure for QuEChERS

In just 3 easy steps, you can prepare any fruit or vegetable sample for multi-class, multi-residue pesticide analysis.



**Selection criteria**

- QuEChERS method
- Compounds for screening

Use buffered kits if base-sensitive pesticides are present. Agilent recommends using buffered kits as a first choice.

**Selection criteria**

- QuEChERS method
- Food type to be analyzed
- Aliquot volume

\*Aliquot size is specified by the method, and kits are created for these specific amounts. For pesticides with acidic groups (phenoxyacanoic acids), analyze directly by LC/MS/MS at this point (skip the dispersive SPE stage). These acidic groups interact with the PSA that is part of the dispersive SPE step.



QuEChERS AOAC 2007.01 extraction kit, 5982-5755



Ceramic homogenizer for 50 mL tubes, 5982-9313

## QuEChERS Extraction Kits

- Available with or without 50 mL centrifuge tubes and caps
- Include MgSO<sub>4</sub>, NaCl, or other salts for buffering; pre-weighed in anhydrous packet

### Step 1: Extraction

Choose the extraction salt packet based on your method of analysis, AOAC or EN. The buffered extraction salts are amenable for more labile pesticides. Adding solvent and then salts to a comminuted fruit or vegetable sample (10 g or 15 g) enables you to extract the pesticides of interest into the organic layer. Agilent pre-packages its QuEChERS salts and buffers in anhydrous packages. This allows you to add them after adding your solvent to the sample, as specified in QuEChERS methodologies.

**In the table below, the "CH" products contain the appropriately sized CH for those particular kits. For more information on Ceramic Homogenizers see page 99.**

### QuEChERS Extraction Kits

| Method                     | Buffered | Contents   | Ceramic Homogenizers | With 50 mL Tubes<br>50/pk | Packets Only |           |
|----------------------------|----------|--|----------------------|---------------------------|--------------|-----------|
|                            |          |  |                      |                           | 50/pk        | 200/pk    |
| AOAC 2007.01               | Yes      | 6 g MgSO <sub>4</sub> ; 1.5 g NaAcetate  | Yes                  | 5982-5755CH               |              |           |
|                            |          |  | No                   | 5982-5755                 | 5982-6755    | 5982-7755 |
| Original<br>(10 g samples) | No       | 4 g MgSO <sub>4</sub> ; 1 g NaCl   | Yes                  | 5982-5550CH               |              |           |
|                            |          |  | No                   | 5982-5550                 | 5982-6550    | 5982-7550 |
| Original<br>(15 g samples) | No       | 6 g MgSO <sub>4</sub> ; 1.5 g NaCl   | Yes                  | 5982-5555CH               |              |           |
|                            |          |  | No                   | 5982-5555                 | 5982-6555    | 5982-7555 |
| EN 15662                   | Yes      | 4 g MgSO <sub>4</sub> ; 1 g NaCl; 1 g NaCitrate;<br>0.5 g disodium citrate sesquihydrate | Yes                  | 5982-5650CH               |              |           |
|                            |          |  | No                   | 5982-5650                 | 5982-6650    | 5982-7650 |
| Acrylamides*               | No       | 4 g MgSO <sub>4</sub> ; 0.5 g NaCl   | No                   | 5982-5850                 |              |           |
| Veterinary Drugs**         | No       | 4g Na2SO4, 1 g NaCl  | No                   | 5982-0032                 |              |           |

\*Katerina Mastovaka and Steven J. Lehotay have done work to extend the scope of QuEChERS beyond fruits and vegetables(1), using it to extract acrylamides in potato chips and other fried foods.

\*\*See Application Note publication number 5991-0013EN: Screening 36 Veterinary Drugs in Animal Origin Food by LC/MS/MS Combined with Modified QuEChERS Method.

1: "Rapid Sample Preparation Method for LC-MS/MS or GC-MS Analysis of Acrylamides in Various Food Matrices", J. Agric. Food Chem, 2006, 54, 7001-7008.

## QuEChERS Dispersive Kits

### Step 2: Dispersive SPE Cleanup

Select the Dispersive SPE kit suited to the type of food being analyzed and the method you are following. In this step, an aliquot of the sample extract from Step One is added to a 2 mL or 15 mL centrifuge tube containing a small amount of SPE sorbent and MgSO<sub>4</sub>. The sorbent will pull out interfering matrix materials from the sample, while the MgSO<sub>4</sub> helps remove excess water and improve analyte partitioning. Select kits are now available with ceramic homogenizers (2 per tube). Their part numbers are designated by a CH.



QuEChERS dispersive kit, 5982-5022



QuEChERS dispersive kit, 5982-5022CH

### QuEChERS Dispersive Kits, Fruits and Vegetables

| Kit  | Size  | Unit        | AOAC 2007.01 Method       | European Method EN 15662 |
|--|-------|-------------|---------------------------|--------------------------|
|  |       |             | Kit Contents Part No.     | Kit Contents Part No.    |
| <b>General fruits and vegetables:</b><br>Removes polar organic acids, some sugars and lipids                           | 2 mL  | 100/pk      | 50 mg PSA                 | 25 mg PSA                |
|  |       |             | 150 mg MgSO <sub>4</sub>  | 150 mg MgSO <sub>4</sub> |
|  |       |             | 5982-5022                 | 5982-5021                |
|  |       |             | 5982-5022CH               | 5982-5021CH              |
|  | 15 mL | 50/pk       | 400 mg PSA                | 150 mg PSA               |
|  |       |             | 1200 mg MgSO <sub>4</sub> | 900 mg MgSO <sub>4</sub> |
|  |       |             | 5982-5058                 | 5982-5056                |
|  |       |             | 5982-5058CH               | 5982-5056CH              |
| <b>Fruits and vegetables with fats and waxes:</b><br>Removes polar organic acids, some sugars, more lipids and sterols | 2 mL  | 100/pk      | 50 mg PSA                 | 25 mg PSA                |
|  |       |             | 50 mg C18EC               | 25 mg C18EC              |
|  |       |             | 150 mg MgSO <sub>4</sub>  | 150 mg MgSO <sub>4</sub> |
|  |       |             | 5982-5122                 | 5982-5121                |
|  |       | 5982-5122CH | 5982-5121CH               |                          |
|  | 15 mL | 50/pk       | 400 mg PSA                | 150 mg PSA               |
|  |       |             | 400 mg C18EC              | 150 mg C18EC             |
|  |       |             | 1200 mg MgSO <sub>4</sub> | 900 mg MgSO <sub>4</sub> |
|  |       |             | 5982-5158                 | 5982-5156                |
|  |       | 5982-5158CH | 5982-5156CH               |                          |



Part numbers ending in CH indicate tubes containing ceramic homogenizers.

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QuEChERS Dispersive Kits, Fruits and Vegetables



| Kit  | Size  | Unit   | AOAC 2007.01 Method   | European Method EN 15662  |
|--|-------|--------|---|---|
|  |       |        | Kit Contents Part No.   | Kit Contents Part No.   |
| <b>Pigmented fruits and vegetables:</b><br>Removes polar organic acids, some sugars and lipids, and carotenoids and chlorophyll; not for use with planar pesticides                        | 2 mL  | 100/pk | 50 mg PSA<br>50 mg GCB<br>150 mg MgSO <sub>4</sub><br>5982-5222<br>5982-5222CH                    | 25 mg PSA<br>2.5 mg GCB<br>150 mg MgSO <sub>4</sub><br>5982-5221<br>5982-5221CH |
|  | 15 mL | 50/pk  | 400 mg PSA<br>400 mg GCB<br>1200 mg MgSO <sub>4</sub><br>5982-5258<br>5982-5258CH                 | 150 mg PSA<br>15 mg GCB<br>885 mg MgSO <sub>4</sub><br>5982-5256<br>5982-5256CH |
| <b>Highly pigmented fruits and vegetables:</b><br>Removes polar organic acids, some sugars and lipids, plus high levels of carotenoids and chlorophyll; not for use with planar pesticides | 2 mL  | 100/pk |   | 25 mg PSA<br>7.5 mg GCB<br>150 mg MgSO <sub>4</sub><br>5982-5321<br>5982-5321CH |
|  | 15 mL | 50/pk  |   | 150 mg PSA<br>45 mg GCB<br>855 mg MgSO <sub>4</sub><br>5982-5356<br>5982-5356CH |
| <b>Fruits and vegetables with pigments and fats:</b><br>Removes polar organic acids, some sugars and lipids, plus carotenoids and chlorophyll; not for use with planar pesticides          | 2 mL  | 100/pk | 50 mg PSA<br>50 mg GCB<br>150 mg MgSO <sub>4</sub><br>50 mg C18EC<br>5982-5421<br>5982-5421CH     |   |
|  | 15 mL | 50/pk  | 400 mg PSA<br>400 mg GCB<br>1200 mg MgSO <sub>4</sub><br>400 mg C18EC<br>5982-5456<br>5982-5456CH |   |

Part numbers ending in CH indicate tubes containing ceramic homogenizers.

### QuEChERS Dispersive Kits: Other Food Methods

| Kit  | Size  | Unit   | AOAC 2007.01 Method  | European Method EN 15662 |
|--|-------|--------|--|--------------------------|
|  |       |        | Kit Contents Part No.  | Kit Contents Part No.    |
| <b>Other Food Methods</b><br>Removes biological matrix interferences, including hydrophobic substances (fats, lipids) and proteins                     | 2 mL  | 100/pk | 25 mg C18<br>150 mg MgSO <sub>4</sub><br>5982-4921<br>5982-4921CH                            |                          |
|  | 15 mL | 50/pk  | 150 mg C18<br>900 mg MgSO <sub>4</sub><br>5982-4956<br>5982-4956CH                           |                          |
| <b>All Food Types</b><br>Removes all matrix interfering materials including polar organic acids, lipids, sugars, proteins, carotenoids and chlorophyll | 2 mL  | 100/pk | 50 mg PSA<br>50 mg C18<br>7.5 mg GCB<br>150 mg MgSO <sub>4</sub><br>5982-0028<br>5982-0028CH |                          |
|  | 15 mL | 50/pk  | 400mg PSA<br>400 mg C18<br>45 mg GCB<br>1200 MgSO <sub>4</sub><br>5982-0029<br>5982-0029CH   |                          |
| <b>Animal Origin Food</b><br>Removes matrix interferences such as polar organic salts, sugars, lipids and proteins                                     | 15 mL | 50/pk  | 50 mg PSA<br>150 mg C18EC<br>900 mg Na <sub>2</sub> SO <sub>4</sub><br>5982-4950             |                          |

Part numbers ending in CH indicate tubes containing ceramic homogenizers.



### TIPS & TOOLS

View the core concepts surrounding the QuEChERS method at [www.agilent.com/chem/QuEChERSvideo](http://www.agilent.com/chem/QuEChERSvideo)



**Suggested Bond Elut QuEChERS Dispersive Kit by Food Type and Method**

| Commodity Group  | Commodity       | General Fruits and Vegetables EN or AOAC | Fruits and Vegetables w/Fats and Waxes; EN or AOAC | Pigmented Fruits and Vegetables EN or AOAC                      | Highly Pigmented Fruits and Vegetables; EN                             | Fruits and Vegetables w/Pigment and Fats; AOAC only |
|--|-----------------|--|--|---|--|---|
| Use With   |                 | Lightly colored samples                  | Samples containing > 1% Fat/Lipids                 | Colored samples (chloryphyl, carotinoids), no planar pesticides | Highly colored samples (chloryphyl, carotinoids), no planar pesticides | Colored samples that also contain fats or waxes     |
| Fruits   |                 |  |  |   |  |   |
| <br>Citrus Fruits           | citrus juices   |  |  |   |  |   |
|  | grapefruit      |  |  |   |  |   |
|  | lemon/lime      |  |  |   |  |   |
|  | orange          |  |  |   |  |   |
|  | orange peel     |  |  |   |  |   |
|  | nectarine       |  |  |   |  |   |
|  | tangerine       |  |  |   |  |   |
| <br>Pome Fruits             | apple           |  |  |   |  |   |
|  | apple, dried    |  |  |   |  |   |
|  | apple sauce     |  |  |   |  |   |
|  | apple juice     |  |  |   |  |   |
|  | pear            |  |  |   |  |   |
| <br>Stone Fruits            | quince          |  |  |   |  |   |
|  | apricot         |  |  |   |  |   |
|  | apricot, dried  |  |  |   |  |   |
|  | apricot nectar  |  |  |   |  |   |
|  | cherry          |  |  |   |  |   |
|  | mirabelle       |  |  |   |  |   |
|  | nectarine       |  |  |   |  |   |
|  | peach           |  |  |   |  |   |
|  | peach, dried    |  |  |   |  |   |
|  | plum            |  |  |   |  |   |
| <br>Soft and Small Fruits | plum, dried     |  |  |   |  |   |
|  | blackberry      |  |  |   |  |   |
|  | blueberry       |  |  |   |  |   |
|  | currant         |  |  |   |  |   |
|  | elderberry      |  |  |   |  |   |
|  | gooseberry, red |  |  |   |  |   |
|  | grapes, red     |  |  |   |  |   |
|  | grapes, green   |  |  |   |  |   |
|  | raspberry       |  |  |   |  |   |
|  | raisin          |  |  |   |  |   |
|  | cranberry       |  |  |   |  |   |
|  | strawberry      |  |  |   |  |   |
| <br>Other Fruits          | pineapple       |  |  |   |  |   |
|  | banana          |  |  |   |  |   |
|  | avocado         |  |  |   |  |   |
|  | olives          |  |  |   |  |   |
|  | fig, dried      |  |  |   |  |   |
|  | melon           |  |  |   |  |   |
|  | kiwi            |  |  |   |  |   |
|  | mango           |  |  |   |  |   |
| papaya   |                 |  |  |   |  |   |

(Continued)

**Suggested Bond Elut QuEChERS Dispersive Kit by Food Type and Method**

| Commodity Group   | Commodity                     | General Fruits and Vegetables EN or AOAC | Fruits and Vegetables w/Fats and Waxes; EN or AOAC | Pigmented Fruits and Vegetables EN or AOAC                      | Highly Pigmented Fruits and Vegetables; EN                             | Fruits and Vegetables w/Pigment and Fats; AOAC only |
|---|-------------------------------|--|--|---|--|---|
| Use With  |                               | Lightly colored samples                  | Samples containing > 1% Fat/Lipids                 | Colored samples (chloryphyl, carotinoids), no planar pesticides | Highly colored samples (chloryphyl, carotinoids), no planar pesticides | Colored samples that also contain fats or waxes     |
| Vegetables  |                               |  |  |   |  |   |
| <br>Root and Tuber Vegetables    | beets                         |  |  |   |  |   |
|   | carrot                        |  |  |   |  |   |
|   | celeriac                      |  |  |   |  |   |
|   | horseradish                   |  |  |   |  |   |
|   | parsley root                  |  |  |   |  |   |
|   | radish                        |  |  |   |  |   |
|   | black salsify                 |  |  |   |  |   |
|   | potato                        |  |  |   |  |   |
| <br>Leek Plants                  | garlic                        |  |  |   |  |   |
|   | onion                         |  |  |   |  |   |
|   | scallion                      |  |  |   |  |   |
|   | leek                          |  |  |   |  |   |
|   | shallot                       |  |  |   |  |   |
|   | chive                         |  |  |   |  |   |
| <br>Fruiting Vegetables          | eggplant/aubergine            |  |  |   |  |   |
|   | cucumber                      |  |  |   |  |   |
|   | pepper, sweet green           |  |  |   |  |   |
|   | pepper, sweet, red            |  |  |   |  |   |
|   | pumpkin                       |  |  |   |  |   |
|   | tomato                        |  |  |   |  |   |
|   | zucchini (courgette)          |  |  |   |  |   |
| <br>Broccoli                   | broccoli                      |  |  |   |  |   |
|   | brussels sprouts              |  |  |   |  |   |
|   | cauliflower                   |  |  |   |  |   |
|   | chinese cabbage               |  |  |   |  |   |
|   | kale                          |  |  |   |  |   |
|   | kohlrabi                      |  |  |   |  |   |
|   | red cabbage                   |  |  |   |  |   |
|   | savoy cabbage                 |  |  |   |  |   |
| white cabbage   |                               |  |  |   |  |   |
| <br>Leafy Vegetables and Herbs | lettuce varieties             |  |  |   |  |   |
|   | endive                        |  |  |   |  |   |
|   | cress                         |  |  |   |  |   |
|   | lamb's lettuce                |  |  |   |  |   |
|   | cilantro                      |  |  |   |  |   |
|   | basil                         |  |  |   |  |   |
|   | parsley                       |  |  |   |  |   |
|   | rucola, arugula               |  |  |   |  |   |
| spinach   |                               |  |  |   |  |   |
| <br>Stem Vegetables            | asparagus                     |  |  |   |  |   |
|   | celery                        |  |  |   |  |   |
|   | leek                          |  |  |   |  |   |
|   | rhubarb                       |  |  |   |  |   |
|   | artichokes                    |  |  |   |  |   |
| <br>Legumes                    | beans, peas, lentils, (fresh) |  |  |   |  |   |
|   | beans, peas, lentils, (dried) |  |  |   |  |   |

(Continued)

**Suggested Bond Elut QuEChERS Dispersive Kit by Food Type and Method**

| Commodity Group   | Commodity                 | General Fruits and Vegetables EN or AOAC | Fruits and Vegetables w/Fats and Waxes; EN or AOAC | Pigmented Fruits and Vegetables EN or AOAC                      | Highly Pigmented Fruits and Vegetables; EN                             | Fruits and Vegetables w/Pigment and Fats; AOAC only |
|---|---------------------------|--|--|---|--|---|
| Use With  |                           | Lightly colored samples                  | Samples containing > 1% Fat/Lipids                 | Colored samples (chloryphyl, carotinoids), no planar pesticides | Highly colored samples (chloryphyl, carotinoids), no planar pesticides | Colored samples that also contain fats or waxes     |
| <b>Animal-Sourced Foods</b>   |                           |  |  |   |  |   |
| Meats                    | beef, pork, veal, chicken |  |  |   |  |   |
|   | liver, kidney             |  |  |   |  |   |
| Seafood                  | finfish                   |  |  |   |  |   |
|   | bivalve, shellfish        |  |  |   |  |   |
| Dairy                    | dairy                     |  |  |   |  |   |
| <b>Other Foods</b>  |                           |  |  |   |  |   |
| Cereals                  | wheat, corn, rice         |  |  |   |  |   |
|   | grain, flour, etc.        |  |  |   |  |   |
| Tea/Coffee               | coffee beans              |  |  |   |  |   |
|   | tea leaves                |  |  |   |  |   |
| Dried Spices            | peppercorn seeds          |  |  |   |  |   |
|   | peppers, curry            |  |  |   |  |   |
|   | leek plants               |  |  |   |  |   |
| Oils                   | olive, canola             |  |  |   |  |   |
|   | citrus                    |  |  |   |  |   |
| Baby Food              | baby food                 |  |  |   |  |   |
| <b>Other</b>  |                           |  |  |   |  |   |
| Agricultural Products  | tobacco                   |  |  |   |  |   |
|   | cotton, hemp              |  |  |   |  |   |
|   | cocoa solids              |  |  |   |  |   |
| Soil                   | soil                      |  |  |   |  |   |
| Whole Blood            | whole blood               |  |  |   |  |   |

**TIPS & TOOLS**



Access the complete QuEChERS applications library at [www.agilent.com/chem/QuEChERS](http://www.agilent.com/chem/QuEChERS)

## QuEChERS Ceramic Homogenizers

Ceramic homogenizers increase your overall lab productivity and give you greater confidence in your results. They make analyte extraction easier by:

- Cutting the required extraction time from 60 seconds to as little as 20 seconds – a time savings of 70% per sample
- Maintaining high, reproducible extractions in a third of the time
- Minimizing variance between technicians
- Breaking up salt agglomerates and maintaining a consistent grinding of homogenizing material

The same great ceramic homogenizers available in our QuEChERS Kits are also available for bulk purchase, providing excellent grinding capabilities of the samples.

### QuEChERS Ceramic Homogenizers

| Description                         | Unit   | Part No.  |
|-------------------------------------|--------|-----------|
| Ceramic homogenizer for 50 mL tubes | 100/pk | 5982-9313 |
| Ceramic homogenizer for 15 mL tubes | 100/pk | 5982-9312 |
| Ceramic homogenizer for 2 mL tubes  | 200/pk | 5982-9311 |



Ceramic homogenizer for 50 mL tubes, 5982-9313

## Standards for QuEChERS Products

In addition to our industry-leading QuEChERS Kits, Agilent makes your analysis easier by providing standards for the most commonly used regulatory methods, including AOAC and EN.

- Save time and avoid inconvenience of making standards
- Available for both GC and LC instruments
- Ready to use for QuEChERS extractions – no dilutions required

### Standards for QuEChERS Products

| Description                              | Concentration           | Kit Contents  | Part No.  |
|--|-------------------------|---|-----------|
| HPLC & GC Internal Standard, AOAC Method | 1000 µg/mL              | Parathion-d10 (diethyl-d10), Alpha-BHC-d6 (alpha-HCH-d6)                                  | 5190-0502 |
| QC Solution, AOAC Method                 | 500 µg/mL               | Triphenyl phosphate   | 5190-0503 |
| HPLC Internal Standard, EN Method        | 100 µg/mL               | Tris (1,3-dichloroisopropyl) phosphate, Nicarbazin  | 5190-0500 |
| GC Internal Standard, EN Method          | 5000 µg/mL              | (2,2',5,5'-tetrachlorobiphenyl), Triphenylmethane, Tris (1,3-dichloroisopropyl) phosphate | 5190-0501 |
| QC Surrogate for GC Standard, EN Method  | 500 µg/mL<br>1000 µg/mL | (2,2',3,4,4',5'-hexachlorobiphenyl)<br>Anthracene-d10                                     | 5190-0499 |