

Supel™ QuE (QuEChERS) Product Line

Description

Dispersive SPE (dSPE), often referred to as the “QuEChERS” method (Quick, Easy, Cheap, Effective, Rugged, and Safe), is a sample prep technique that has become popular in the area of multi-residue pesticide analysis in food and agricultural products.

Food/agricultural samples are first extracted with an aqueous miscible solvent (e.g., acetonitrile) in the presence of high amounts of salts (e.g., sodium chloride and magnesium sulfate) and/or buffering agents (e.g. citrate) to induce liquid phase separation and stabilize acid and base labile pesticides, respectively. Upon shaking and centrifugation, an aliquot of the organic phase is subjected to further cleanup using SPE. Unlike traditional methods using SPE tubes, dSPE cleanup is conducted by mixing bulk amounts of SPE (e.g., Supelclean™ PSA, ENVI-Carb™, and/or Discovery® DSC-18) with the extract. After sample cleanup, the mixture is centrifuged and the resulting supernatant can either be analyzed directly or can be subjected to minor further treatment before analysis.

Supelco now carries a line of Supel QuE centrifuge tubes containing predetermined amounts of salts and SPE sorbents to support the most common method configurations used today. Supelco also offers the Z-Sep sorbents, unique sorbents for analysis in challenging matrices (fatty or lipid containing). The Z-Sep sorbents provide improved sample cleanup over traditional PSA/C18 which can extend analytical column life and instrument throughput. They provide an advantage especially for analysis of more hydrophobic compounds.

Procedure

The two most predominate dispersive methods were developed by Steven Lehotay and Michelangelo Anastassiades. Described below is a summary outline of the methods. For a detailed description of the protocol, please refer to the original references.

Procedure 1 – as described in the following references:

- Official Method EN15662:2008
- M. Anastassiades, QuEChERS – A Mini-Multiresidue Method for the Analysis of Pesticide Residues in Low-Fat Products, <http://www.quechers.com/>

Sample Extraction

1. Weigh 10 g sample into a 50 mL centrifuge tube.
2. Add 10 mL acetonitrile + 100 µL I.S. solution. Shake vigorously for 1 min.
3. Add contents of Supel QuE Citrate Extraction Tube (**55227-U**). Shake vigorously for 1 min., and centrifuge for 5 min. at 3000 U/min.

Note: For pesticides with acidic functional groups (e.g., phenoxyacetic acids), 200 µL of the supernatant should be aliquoted and analyzed directly (without dispersive SPE cleanup) by LC-MS/MS (negative ion mode). Acidic pesticides may retain on the dispersive SPE PSA sorbent resulting in poor recovery.

QuEChERS technique

1. For samples with high fat content and/or waxes (some cereals and citrus fruits), place the extract in the freezer for > 1 hour.
2. Transfer 6 mL of the acetonitrile layer to Supel QuE PSA (EN) Tube (**55228-U or 55437-U**), or transfer 1 mL of the acetonitrile layer to Supel QuE PSA (EN) Tube, 2 mL (**55172-U**).

For samples of higher fat content, use Supel QuE PSA/C18 (EN) Tube (**55229-U, 55439-U, or 55173-U**) or any of Z-Sep/Z-Sep+ sorbents. The Z-Sep materials are more efficient alternatives to the material described in the EN15662:2008.

Procedure 1 (contd.)

For samples with moderate levels of chlorophyll and carotenoids (e.g., carrots, romaine lettuce, head lettuce, etc.), use Supel QuE PSA/ENVI-Carb (EN) Tube 1 (**55230-U, 55446-U, or 55174-U**).

For samples with higher levels of chlorophyll and carotenoids (e.g., red sweet pepper, spinach, lamb's lettuce, rucolla, etc.), use Supel QuE PSA/ENVI-Carb (EN) Tube 2 (**55233-U, 55464-U, or 55176-U**). Alternatively, for improved recovery of planar pesticides in green matrices, use Supel QuE Verde (**55442-U or 55447-U**).

3. Shake for 30 sec. (2 min. when ENVI-Carb is used). Centrifuge for 5 min. at 3000 U/min. Remove a small aliquot of the cleaned extract supernatant for the analysis of sulfonyl urea herbicides, carbo-sulfan, and benfuracarb.
4. Acidify the remaining supernatant by transferring an aliquot of the supernatant to a fresh cap vial and adding 10 µL of 5% formic acid in acetonitrile to every mL of supernatant isolated.

Procedure 2 – as described in the following references:

- AOAC International Official Method 2007.01.
- S.J. Lehotay, K. Mastovska, A.R. Lightfield, Use of Buffer and Other Means to Improve Results of Problematic Pesticides in a Fast and Easy Method for Residue Analysis of Fruits and Vegetables, J-AOAC-Int., Mar-Apr 2005; 88(2):615-629
- S.J. Lehotay, Interlaboratory Validation of the QuEChERS Method to Analyze Pesticide Residues in Fruits and Vegetables, Proceedings AOAC Annual meeting, St. Louis, MO USA (2004)

Sample Extraction

1. Transfer 10-15 g homogenized food sample to 50 mL PTFE centrifuge tube.
2. Per 15 g sample, add 15 mL 1% acetic acid in acetonitrile + contents of Supel QuE Acetate (AC) Tube (**55234-U**) + 75 µL I.S. solution.
3. Shake vigorously 1 min.; Centrifuge > 1500 rcf for 1 min.

QuEChERS technique

1. Transfer 8 mL of acetonitrile layer to Supel QuE PSA (AC) Tube (**55282-U or 55466-U**) or Supel QuE PSA/C18 (AC) Tube (**55283-U or 55470-U**). Or transfer 1 mL of acetonitrile layer to Supel QuE PSA (AC) Tube, 2 mL (**55287-U**) or Supel QuE PSA/C18 (AC) Tube, 2 mL (**55288-U**). As a more efficient alternative to the PSA/C18 material described in the AOAC 2007.01 use any of Z-Sep/Z-Sep+ sorbents.

For samples with higher level of chlorophyll or carotenoids, use Supel QuE PSA/C18/ENVI-Carb (AC) Tube (**55286-U or 55474-U**) or Supel QuE PSA/C18/ENVI-Carb (AC) Tube, 2 mL (**55289-U**). Alternatively, for improved recovery of planar pesticides in green matrices, use Supel QuE Verde (**55442-U or 55447-U**).

2. Centrifuge > 1500 rcf for 1 min.
3. Transfer supernatant to a GC or LC vial for concurrent LC-MS and GC-MS analysis. Note that further processing may be necessary prior to chromatographic analysis (e.g., addition of formic acid for LC-MS analysis; or evaporation of supernatant and reconstitute with toluene for GC-MS analysis).

Pre-Packed dSPE Tubes

Description	Qty.	Cat. No.
EN15662:2008 (15 mL centrifuge tubes, shaker compatible)		
Supel QuE PSA (EN) Tube, 15 mL 150 mg Supelclean PSA, 900 mg MgSO ₄	50	55437-U
Supel QuE PSA/C18 (EN) Tube, 15 mL 150 mg Supelclean PSA, 150 mg Discovery DSC-18, 900 mg MgSO ₄	50	55439-U
Supel QuE PSA/ENVI-Carb (EN) Tube 1, 15 mL 150 mg Supelclean PSA, 15 mg Supelclean ENVI-Carb, 900 mg MgSO ₄	50	55446-U
Supel QuE PSA/ENVI-Carb (EN) Tube 2, 15 mL 150 mg Supelclean PSA, 45 mg Supelclean ENVI-Carb, 900 mg MgSO ₄	50	55464-U
EN15662:2008 (12 mL centrifuge tubes)		
Supel QuE Citrate (EN) Tube 4 g MgSO ₄ , 1 g NaCl, 0.5 g NaCitrate dibasic sesquihydrate, 1 g NaCitrate tribasic dehydrate	50	55227-U
Supel QuE Citrate/Sodium Bicarbonate (EN) Tube 4 g MgSO ₄ , 5 g NaBicarbonate, 1 g NaCl, 0.5 g NaCitrate dibasic sesquihydrate, 1 g NaCitrate tribasic dehydrate	50	55237-U
Supel QuE PSA (EN) Tube 150 mg Supelclean PSA, 900 mg MgSO ₄	50	55228-U
Supel QuE PSA/C18 (EN) Tube 150 mg Supelclean PSA, 150 mg Discovery DSC-18, 900 mg MgSO ₄	50	55229-U
Supel QuE PSA/ENVI-Carb (EN) Tube 1 150 mg Supelclean PSA, 15 mg Supelclean ENVI-Carb, 900 mg MgSO ₄	50	55230-U
Supel QuE PSA/ENVI-Carb (EN) Tube 2 150 mg Supelclean PSA, 45 mg Supelclean ENVI-Carb, 900 mg MgSO ₄	50	55233-U
EN15662:2008 (2 mL centrifuge tubes)		
Supel QuE PSA (EN) Tube, 2 mL 25 mg Supelclean PSA, 150 mg MgSO ₄	100	55172-U
Supel QuE PSA/C18 (EN) Tube, 2 mL 25 mg Supelclean PSA, 25 mg Discovery DSC-18, 150 mg MgSO ₄	100	55173-U
Supel QuE PSA/ENVI-Carb (EN) Tube 1, 2 mL 25 mg Supelclean PSA, 2.5 mg Supelclean ENVI-Carb, 150 mg MgSO ₄	100	55174-U
Supel QuE PSA/ENVI-Carb (EN) Tube 2, 2 mL 25 mg Supelclean PSA, 7.5 mg Supelclean ENVI-Carb, 150 mg MgSO ₄	100	55176-U
AOAC 2007.01 (15 mL centrifuge tubes, shaker compatible)		
Supel QuE PSA (AC) Tube, 15 mL 400 mg Supelclean PSA, 1200 mg MgSO ₄	50	55466-U
Supel QuE PSA/C18 (AC) Tube, 15 mL 400 mg Supelclean PSA, 400 mg Discovery DSC-18, 1200 mg MgSO ₄	50	55470-U
Supel QuE PSA/C18/ENVI-Carb (AC) Tube, 15 mL 400 mg Supelclean PSA, 400 mg Discovery DSC-18, 400 mg Supelclean ENVI-Carb, 1200 mg MgSO ₄	50	55474-U
AOAC 2007.01 (12 mL centrifuge tubes)		
Supel QuE Acetate (AC) Tube 6 g MgSO ₄ , 1.5 g NaAcetate	50	55234-U
Supel QuE PSA (AC) Tube 400 mg Supelclean PSA, 1200 mg MgSO ₄	50	55282-U
Supel QuE PSA/C18 (AC) Tube 400 mg Supelclean PSA, 1200 mg MgSO ₄ , 400 mg Discovery DSC-18	50	55283-U
Supel QuE PSA/C18/ENVI-Carb (AC) Tube 400 mg Supelclean PSA, 1200 mg MgSO ₄ , 400 mg Discovery DSC-18, 400 mg ENVI-Carb	50	55286-U
AOAC 2007.01 (2 mL centrifuge tubes)		
Supel QuE PSA (AC) Tube, 2 mL 50 mg Supelclean PSA, 150 mg MgSO ₄	100	55287-U
Supel QuE PSA/C18 (AC) Tube, 2 mL 50 mg Supelclean PSA, 150 mg MgSO ₄ , 50 mg Discovery DSC-18	100	55288-U
Supel QuE PSA/C18/ENVI-Carb (AC) Tube, 2 mL 50 mg Supelclean PSA, 150 mg MgSO ₄ , 50 mg Discovery DSC-18, 50 mg ENVI-Carb	100	55289-U
Supel QuE PSA/ENVI-Carb (AC) Tube, 2 mL 50 mg Supelclean PSA, 150 mg MgSO ₄ , 50 mg ENVI-Carb	100	Custom

Description	Qty.	Cat. No.
Specialty Products for Challenging Matrices and Analytes (2 mL centrifuge tubes)		
Supel QuE Z-Sep Tube 75 mg Z-Sep	100	55411-U
Supel QuE Z-Sep/MgSO ₄ Tube 50 mg Z-Sep, 150 mg MgSO ₄	100	55417-U
Supel QuE Z-Sep/C18 Tube 20 mg Z-Sep, 50 mg Discovery DSC-18	100	55284-U
Supel QuE Z-Sep+ Tube 75 mg Z-Sep+	100	55408-U
Supel QuE Z-Sep+/MgSO ₄ Tube 50 mg Z-Sep+, 150 mg MgSO ₄	100	55414-U
Supel QuE Verde Tube 60 mg Z-Sep+, 50 mg Supelclean PSA, 10 mg Supelclean ENVI-Carb Y, 150 mg MgSO ₄	100	55447-U
15 mL centrifuge tubes, shaker compatible		
Supel QuE Z-Sep Tube, 15 mL 500 mg Z-Sep	50	55491-U
Supel QuE Z-Sep/MgSO ₄ Tube, 15 mL 300 mg Z-Sep, 900 mg MgSO ₄	50	55503-U
Supel QuE Z-Sep/C18 Tube, 15 mL 120 mg Z-Sep, 300 mg Discovery DSC-18	50	55506-U
Supel QuE Z-Sep+ Tube, 15 mL 500 mg Z-Sep+	50	55486-U
Supel QuE Z-Sep+/MgSO ₄ Tube, 15 mL 300 mg Z-Sep+, 900 mg MgSO ₄	50	55511-U
Supel QuE Verde Tube 480 mg Z-Sep+, 400 mg Supelclean PSA, 80 mg Supelclean ENVI-Carb Y, 1200 mg MgSO ₄	50	55442-U
12 mL centrifuge tubes		
Supel QuE Z-Sep Tube 500 mg Z-Sep	50	55403-U
Supel QuE Z-Sep/MgSO ₄ Tube 300 mg Z-Sep, 900 mg MgSO ₄	50	55407-U
Supel QuE Z-Sep/C18 Tube 120 mg Z-Sep, 300 mg Discovery DSC-18	50	55401-U
Supel QuE Z-Sep+ Tube 500 mg Z-Sep+	50	55296-U
Supel QuE Z-Sep+/MgSO ₄ Tube 300 mg Z-Sep+, 900 mg MgSO ₄	50	55406-U
Non-buffered extraction tubes (12 mL centrifuge tubes)		
Supel QuE Non-Buffered Tube 1 4 g MgSO ₄ , 1 g NaCl	50	55294-U
Supel QuE Non-Buffered Tube 2 6 g MgSO ₄ , 1.5 g NaCl	50	55295-U
Specialty Extraction Salts		
Supel QuE Ammonium Sulfate Tube 12 mL) 4 g Ammonium Sulfate	1000	54276-U

Description	Qty.	Cat. No.
Empty Extraction Tubes (50 mL) 50 mL empty Extraction Centrifuge Tubes	50	55248-U

Bulk Adsorbents and Salts

Description	Qty.	Cat. No.
Supelclean PSA, bulk sorbent	100 g	52738-U
Supelclean ENVI-Carb, bulk sorbent	50 g	57210-U
Discovery DSC18, bulk sorbent	100 g	52600-U
Z-Sep+	20 g	55299-U
Z-Sep	20 g	55418-U
MgSO ₄ (as cited in EN15662:2008)	var.	208094
Sodium citrate dibasic sesquihydrate	var.	71635
Sodium citrate tribasic dihydrate	var.	32320
Sodium chloride	var.	71379
Sodium acetate	var.	241245

Custom Supel QuE Products

Supelco has introduced a custom service for these tubes that allows users to easily design their own dispersive SPE tube(s). Please visit us under sigma-aldrich.com/custom-quechers and follow the Custom Services link to get to more detailed information on this service and to download the quote request form.

Trademarks

Discovery, ENVI-Carb, Supel, Supelclean — Sigma-Aldrich Co. LLC