Food Analysis

Sample Preparation Workflow Solutions from Biotage

Biotage®

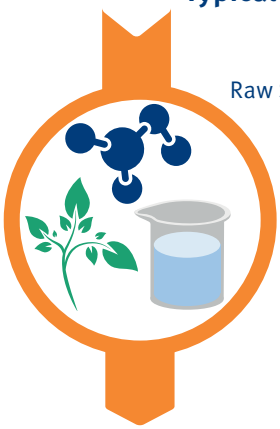
CONTENTS

Sample Preparation Workflows for Food Analysis Applications

Food and Agriculture sample preparation is often complicated by the nature of the sample matrix. Solid or semi-solid samples such as fruit, vegetables, tissue or soil need specialized sample pre-treatment for efficient extraction of the analytes. The complexity of these sample matrices requires robust and reliable methodology.

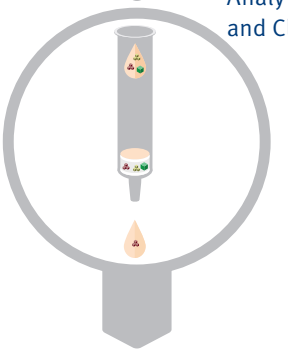
Learn more about our smart sample preparation solutions for simplifying sample handling and clean-up of these difficult samples.

Typical Workflow



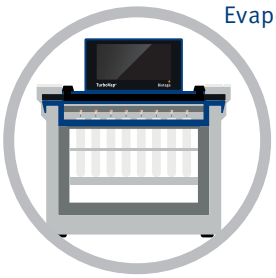
Raw Sample

Pre-treatment



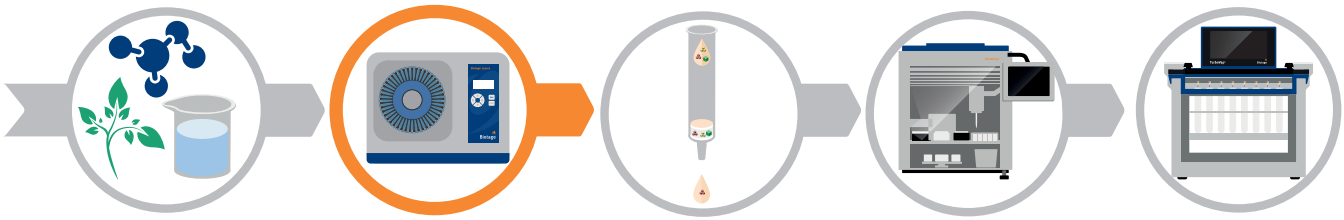
Analyte Extraction and Clean-Up

Processing



Evaporation

Homogenization and Liquid Solid Extraction



Homogenization is used to ensure that all constituents in food sample matrices are fully homogenized, so the final result represents the entire sample.

After homogenization, target analytes are then extracted from the solid matrix into a solvent via liquid solid extraction. It is important to have a fully homogenized sample in order to obtain and effective extraction of the target analytes.

Biotage® Lysera

Some samples may only require a simple whizz in a food processor, but for other food matrices Biotage Lysera is a bead homogenizer capable of preparing representative homogenates of even tough samples like hard or soft animal tissue, plant material and soil.

The design offers a quick and effective approach without jeopardizing sample integrity.

Bead mills improve efficiency and effectiveness of homogenization when compared to traditional laboratory blenders.

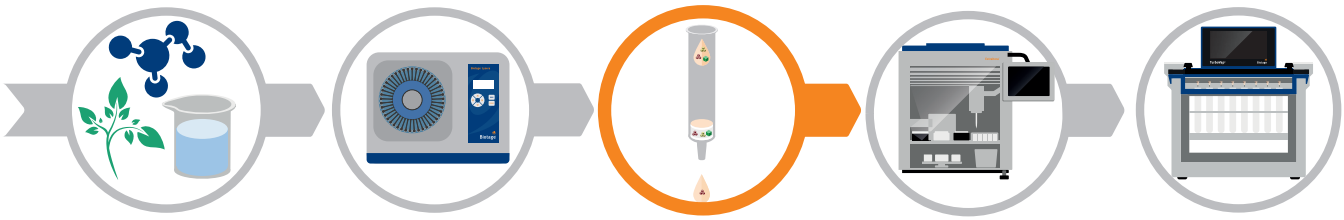
After homogenization, in-situ liquid solid extraction can be performed on the Lysera, eliminating transfer steps and potential loss in recoveries. (Reference AN938)

- Cryo Unit to prevent losses of volatile analytes (for up to 7 mL sample tubes)
- Sample volumes up to 50 mL
- Grind up to 24 samples simultaneously
- Disposable tubes prevent cross contamination

A Range of Tubes and Beads Support Homogenization of Any Sample Type

	Lyse / Disrupt	Homogenize			Grind	
Size	0.5 mm Glass	1.4 mm Ceramic	2.8 mm Ceramic	0.7 mm Garnet	2.4 mm Metal	0.25 mm Carbide
Part Number	19-622	19-627	19-628	19-624	19-620	19-625
Animal						
Skin		✓	✓	✓		
Intestine			✓	✓		
Muscle		✓	✓	✓	✓	
Liver		✓	✓	✓		
Kidney		✓	✓	✓		
Lung		✓	✓	✓		
Heart		✓	✓		✓	
Bone			✓		✓	
Hair			✓	✓	✓	
Fish / Insects						
Insects		✓	✓			
Zebrafish	✓	✓		✓		
Plant						
Leaves			✓		✓	
Seeds			✓		✓	
Rice			✓		✓	
Wheat			✓		✓	
Stems			✓		✓	
Roots			✓		✓	
Moss		✓	✓		✓	
Soil						
Soil		✓	✓	✓	✓	✓
Sediment		✓		✓	✓	✓

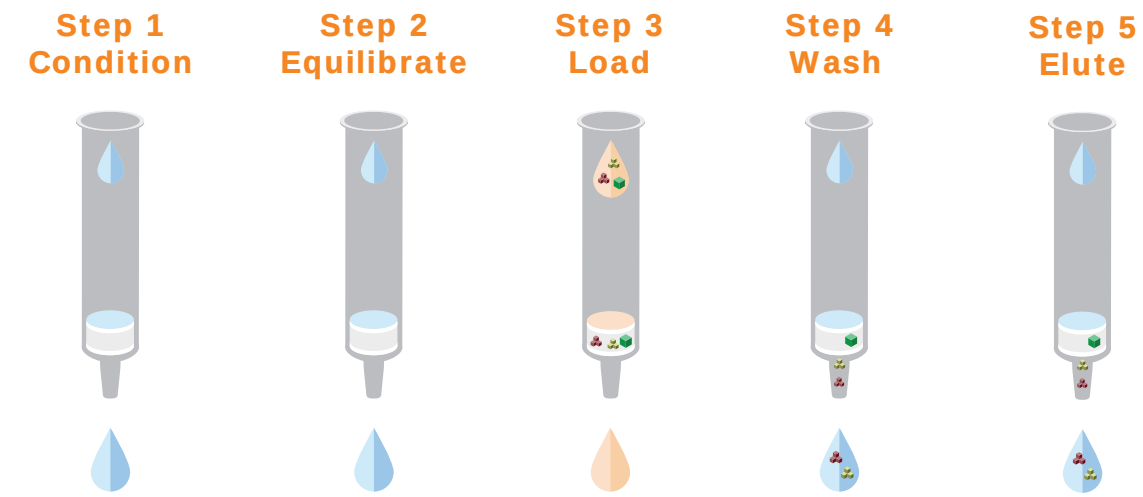
Analyte Extraction and Clean Up



Targeted extraction of your analytes, and extract clean up to ensure that matrix interferences are removed and your analytical system is not compromised, require quality extraction consumables for high analyte recovery and reproducible performance.

Solid phase extraction (SPE) is a very powerful sample preparation technique for extraction of analytes from complex matrices. Biotage ISOLUTE® and EVOLUTE® solid phase extraction columns and plates are available in a comprehensive range of media and sizes to match your application and throughput needs.

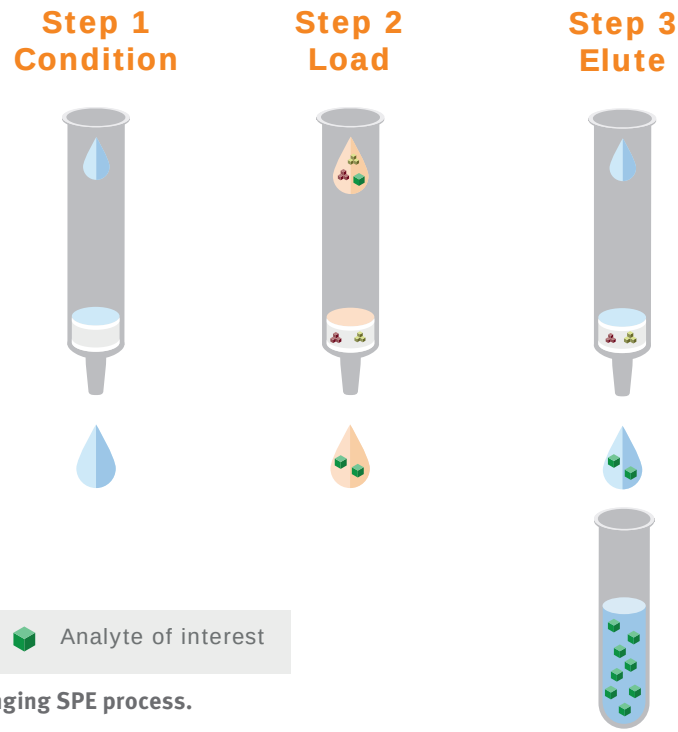
Targeted Analyte Extraction (Catch and Release SPE)
Select an appropriate SPE phase and methodology to selectively retain ('catch') your analytes of interest. wash off interfering matrix components, then elute ('release') the analytes of interest in a highly purified extract.



The classic 'catch and release' SPE process.

Matrix Scavenging SPE

Alternatively, the SPE columns can also be used in 'matrix (or interference) scavenging, mode, where the sample is applied to the column and collected as it passes through. Interferences are trapped on the column, and do not enter the final extract.



The matrix (interference) scavenging SPE process.

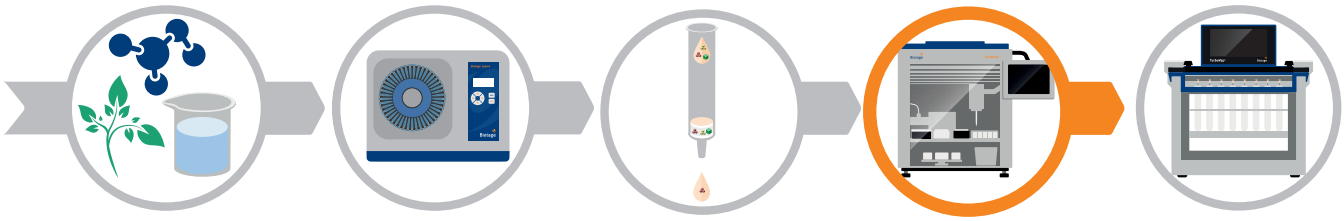
QuEChERS Extraction and Clean-up

The Quechers (Quick, Easy, Cheap, Effective, Rugged and Safe) technique combines initial salt assisted analyte extraction and partitioning with a dispersive SPE clean up stage.

ISOLUTE® Quechers products consist of pre-weighed extraction and clean-up tubes conforming to AOAC and EN methodologies.

Options include high quality dSPE sorbent mixes optimized for waxed and highly pigmented fruit and vegetable samples.

Processing Options



Processing samples couldn't be easier. Biotage offer vacuum and positive pressure based systems. Vacuum systems are well suited for processing larger sample volumes, whereas positive pressure processing can provide better flow control and consistency for lower volumes.

Manual Vacuum Manifolds

Biotage® VacMaster™ 10 and 20

Process 10 or 20 columns in parallel using Biotage® VacMaster manifolds, with flexible rack options to accommodate a variety of collection vessels.

- Process 10 or 20 samples in parallel
- Robust Inert construction materials
- Accessories for easier sample loading and column drying
- Compatible with all sizes

Biotage® VacMaster™ -96

Biotage® VacMaster™-96 manifolds are ideal for high throughput parallel processing of scaled down methods in 96-well plate format

- Process 96 samples in parallel
- SPE and filtration plate formats

VacMaster™ Disk

For larger volumes (e.g. higher volume beverage samples) and faster flow rates for high particulate or viscous samples, Biotage® VacMaster™ Disk is perfect for SPE disk and filtration applications

- Versatile system for reusable or disposable SPE disks
- Increase throughput by connecting up to 8 manifolds

Automated Vacuum Processing

The Biotage® Horizon 5000 is a three-position automated extraction system that conditions, loads the sample (20 mL to 2 L) and elutes the analytes all without user intervention.

- Compatible with SPE and filtration disks and 6 mL column formats
- Clean, rugged system that won't contaminate extracts
- Increase throughput by connecting up to 4 systems using a single PC

Manual Positive Pressure Manifolds

Biotage® PRESSURE+ 48 and PRESSURE+ 96 Positive Pressure Manifolds deliver positive pressure, parallel processing for 1 mL 3 mL and 6 mL column formats, and 96-well plates for smaller scale, high throughput processing. The systems utilize a consistent, uniform flow of positive pressure to move both low and high viscosity liquids through SPE columns.

- Easy to set up and use – only a gas source required
- Uniform flow for enhanced recovery and reproducibility
- Flexible sample processing, up to 48 samples (columns) or 96 samples (well plates) in parallel
- Avoid sample transfer steps

Automated Positive Pressure Manifolds

Biotage® Extrahera™ workstations automate sample processing and do it with engineered precision. Positive pressure processing delivers reproducible, controlled flows in every position, even for viscous, slow flowing samples.

- Optimized for solid phase extraction plus many other sample prep techniques
- Extremely simple method set up
- Save time, lab space and reduce solvent consumption
- Improve data accuracy and consistency
- Free up time for other activities

Biotage® Extrahera™ Classic

For high throughput small volume processing:

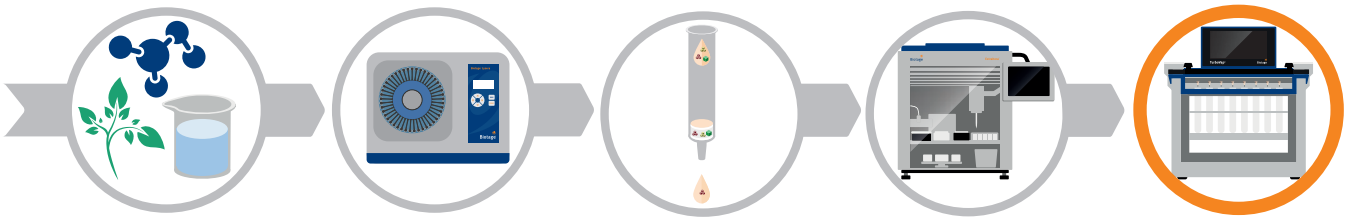
- 24 position configuration can process 24 x 1 mL, 3 mL or 6 mL columns in parallel
- 96 position configuration can process 96-well plates and up to 96 x 1 mL tabless columns
- Accurately dispense 50 µL to 1 mL per channel
- Sample volume range 50 µL–10 mL
- Disposable 1 mL tips to avoid cross contamination
- Switch between configurations quickly and easily for flexible processing

Biotage® Extrahera® HV-5000

For automated processing of larger scale methods:

- Same small footprint for maximum space efficiency
- Process up to 48 x 3 mL, 24 x 6 mL and 12 x 10 mL or 15 mL tables columns simultaneously
- Accurately dispense up to 5000 µL per channel
- Disposable 5 mL tips to avoid cross contamination
- Sample Volume Range: 250 µL–50mL
- Direct Compatibility with front end homogenization tubes
- Eliminates laborious transfer steps required for traditional dSPE

Evaporation



Prior to analysis, an evaporation step is often needed for additional concentration or solvent exchange. TurboVap® blowdown evaporators use a patented vortex evaporation system that increases the speed of evaporation by a factor of 10 compared with other techniques

- Faster evaporation and enhanced throughput
- Simple set up and method optimization
- Easy to use touch screen interface
- Match your extract volume and throughput needs
- Small footprint saves bench or hood space

TurboVap® LV

- Evaporate up to 48 samples simultaneously
- Flexible rack accommodates a wide selection of tubes

TurboVap® II

- Parallel evaporation of up to 6 samples
- Accommodates 50 mL or 200 mL glassware

TurboVap®-96 Dual

- High throughput evaporation for 1 or 2 x 96-well plates
- Independent settings for each position for maximum flexibility
- Adapts for 24 or 48 position evaporation

TurboVap Systems to Streamline your Workflow

In addition, Turbovap® EH and P+ models are designed for streamlined workflow, allowing direct transfer of sample collection racks from processor to evaporator without the need to move tubes from one rack to another

TurboVap® EH accommodates 48 samples contained in tubes up to 18 x 75 mm (2 x 24 position racks). Transfer Biotage® Extrahera™ collection racks direct to the evaporator for maximum workflow efficiency

TurboVap® P+ Samples are processed as normal on the Biotage® PRESSURE+ 48 unit and collection racks can be transferred immediately into the TurboVap P+ for evaporation.

Acrylamide

Highlighted Application

Acrylamide is formed when cooking carbohydrate rich food stuffs (eg breads and pastries, potato products and coffee) at high temperatures.

Acrylamide Workflows from Biotage

1. EN16618 Method

This robust, widely used methodology uses a combination of two SPE columns to clean up and concentrate acrylamide in complex food samples:

Application Notes

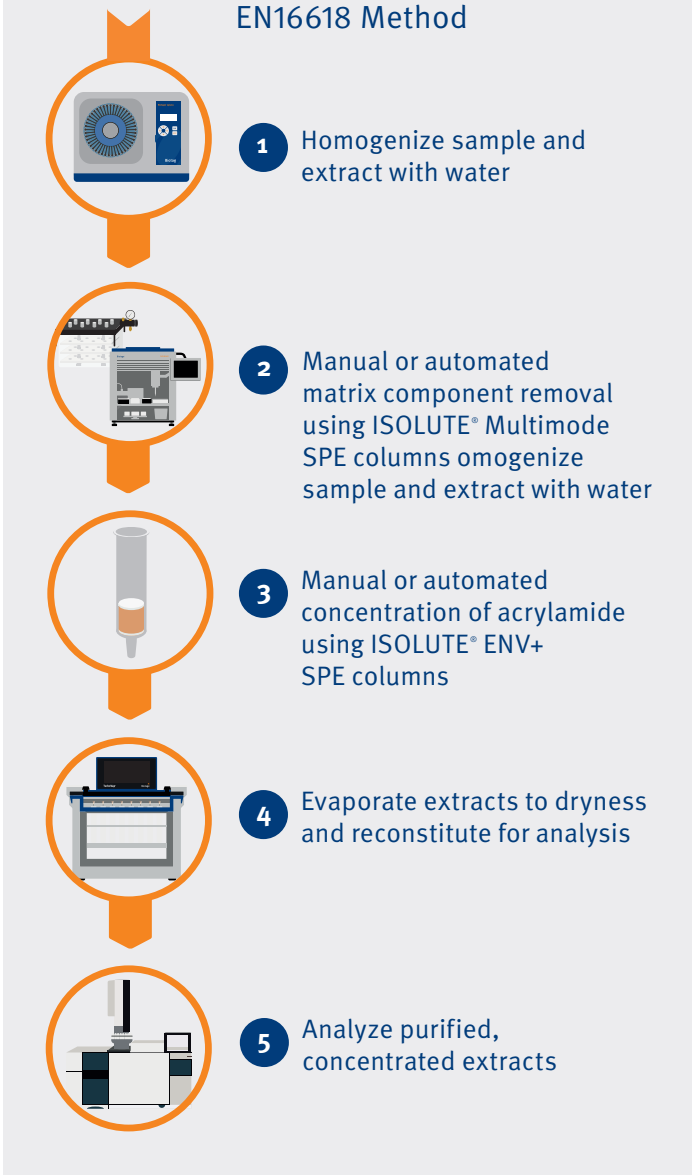
Acrylamide in food (EN16618:2015 method) AN966

Method Scalability

Although the published EN method uses relatively large column formats, the acrylamide extraction and clean up method can be successfully scaled down.

Reduced bed masses bring the advantages of lower sample volumes, and subsequently reduced final extract volumes. This can lead to higher throughput due to reduced processing time and reduced post extraction evaporation.

The table below suggests appropriate volumes for use with reduced bed masses.

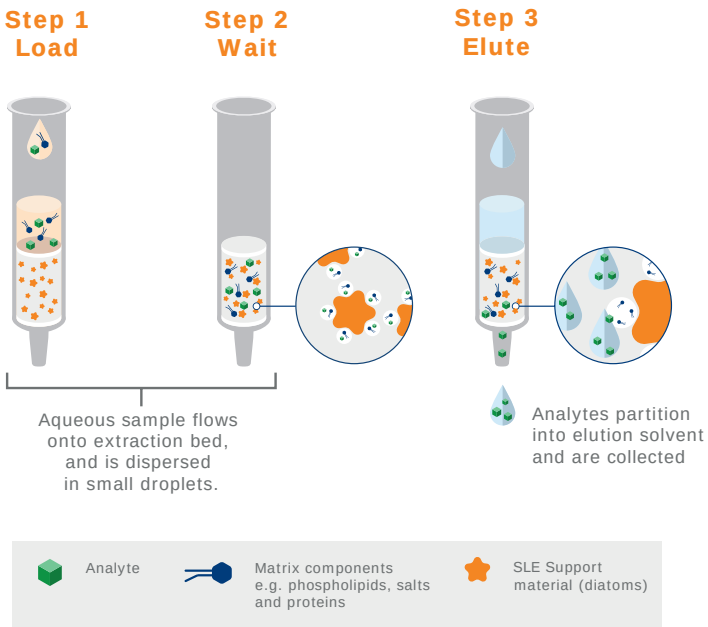


Note: These are based on theoretical considerations, and should be optimized by users.

Format	Column 1 ISOLUTE® Multimode	Column 2 ISOLUTE® ENV+	Load Volume* (onto column 1)	Elute Volume* (from column 2)
Large (EN method)	1 g/6 mL (904-0100-C)	500 mg/6 mL(915-0050-C)	10 mL	2 mL
Medium	500 mg/3 mL (904-0050-B)	200 mg/3 mL(915-0050-B)	5 mL	1 mL
Small	100 mg plate (904-0100-P01)	40 mg plate (915-0040-P01)	1 mL	200 µL–500 µL

2. Simple Supported Liquid Extraction Method

As an alternative to the classic 2 step method Biotage ISOLUTE® SLE+ columns can be used to extract and clean up food extracts in a simple, easy to automate approach.:



Application Notes

Method	Literature No.
Acrylamide from Fried Potato Chips (Crisps)	AN796
Acrylamide from Coffee	AN797

Mycotoxins
Highlighted Application

Mycotoxins are a diverse group of compounds, found in a multitude of different foods and commodities. They are toxic metabolites of moulds, and their structural diversity, range of matrix types and low concentrations makes them challenging to analyze.

ISOLUTE® Myco SPE columns are designed for analysis of mycotoxins by LC-MS/MS. They offer simple and efficient multiple mycotoxin sample preparation from a wide range of matrices.

The simple but effective extraction strategies mean regulated detection limits are easily met for a range of sample matrices.

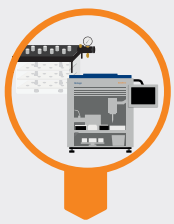
- Optimized for fast, selective LC-MS/MS analysis
- Cost effective option compared to immunoaffinity based clean up
- Robust, easy to use extraction columns and protocols
- Methods are automatable for enhanced throughput

Application Notes

Method	Literature No.
Multiple Mycotoxins in Grain	AN782
Patulin in Apple Juice	AN781
Aflatoxin and Ochratoxin in Dried Chili	AN785
Multiple Mycotoxins in Animal Feed	AN804
Aflatoxin M1 in Infant Formula	AN807
Multiple Mycotoxins in Baby Food	AN823
Multiple Mycotoxins in Nuts	AN784
DON in Grain	AN783

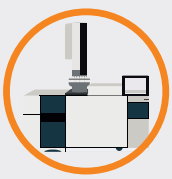
Mycotoxin Workflow from Biotage

1. Homogenize sample and extract with water



2. Clean up mycotoxin extracts using ISOLUTE® Myco SPE columns with manual or automated processing

3. Evaporate extracts to dryness and reconstitute for analysis



4. Analyze purified, concentrated extracts

Pesticide Analysis

Highlighted Application

The wide range of regulated pesticides and the diversity of foodstuffs to be analysed mean tools for pesticide analysis need to be robust and easy to use. Biotage workflows for pesticide analysis include classic Quechers based methods, and methodologies for enhanced extraction of polar pesticides.

QuEChERS Workflow from Biotage
Fast and Efficient clean up of complex food samples. ISOLUTE QuEChERS products provide simple clean-up of complex samples using salt assisted extraction and partitioning, followed by dispersive SPE (dSPE).

Biotage supplies pre-weighed extraction and clean up tubes that conform with AOAC[1,2] and the EU[3] published methods, including those for waxed and highly pigmented fruit and vegetable samples.

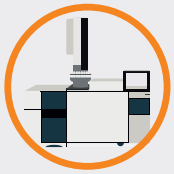
Polar Pesticides Workflow from Biotage
For very polar water-soluble pesticides, ISOLUTE® ENV+ is an extremely retentive SPE phase, capable of retaining polar pesticides that can't be extracted using C18 type SPE media.

QuEChERS Workflow from Biotage

1. Homogenize sample and extract into acetonitrile using QuEChERS extraction tubes

2. Purify sample using dSPE

3. Evaporate extracts to dryness and reconstitute



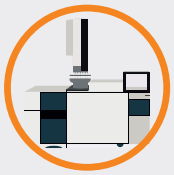
4. Analyze LC-MS/MS or GC-MS(/MS)

Polar Pesticides Workflow from Biotage

1. Homogenize sample and extract sample into suitable aqueous based solution

2. Clean up and concentrate pesticides using ISOLUTE® ENV+ columns and manual or automated processing

3. Evaporate extracts to dryness and reconstitute for analysis



4. Analyze purified, concentrated extracts

References:

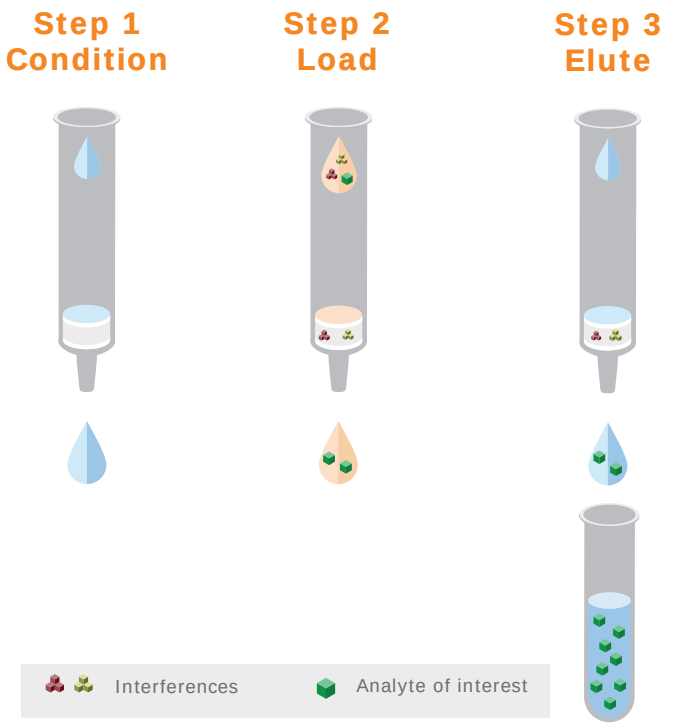
1. AOAC Official Method 2007.01. Pesticide residues in foods by acetonitrile extraction and partitioning with magnesium sulfate.
2. Anastassiades, M., Lehotay, S.J., Stajnbaher, D. and Schenk, F.J. (2003) J AOAC International 86, 412-431.
3. EN 15662. Foods of plant origin- Determination of pesticide residues using GC-MS and /or LC-MS/MS following acetonitrile extraction/partitioning and clean up by dispersive SPE-QuEChERS method.

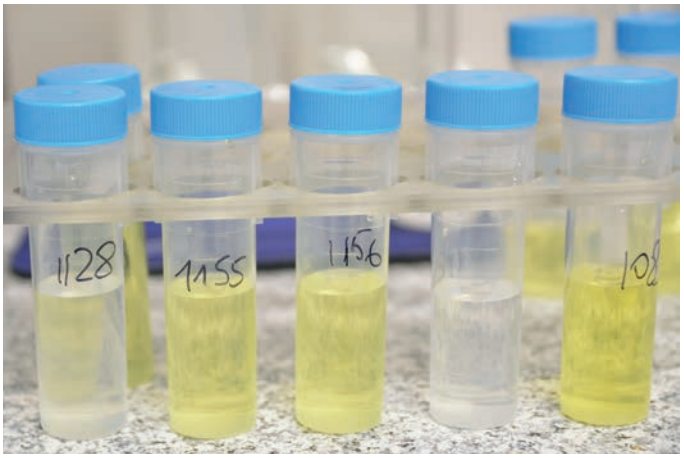
Extract Clean Up

Highlighted Application

A widely used approach to remove food matrix components from extracts and enhance extract cleanliness and detection limits is to use polar (normal phase) SPE columns to trap unwanted components such as pigments and polar fats.

The food sample is extracted into a non-polar solvent, and the extract is passed through a polar SPE column. Polar matrix interferences are trapped, and non-polar analytes pass though unretained and are collected for analysis.





Typical Applications:

- PAHs in oils
- Organochlorine pesticides in plant extracts

In this type of application, it is important that the characteristics of the polar SPE sorbents are tightly controlled, leading to reproducible performance from batch to batch.

The extraction media, columns and components must be clean and contaminant free. Every batch of ISOLUTE® polar SPE sorbents are QC tested to ensure reproducible performance, and pre-packed into clean, contaminant free SPE cartridges for convenient use.

ISOLUTE® Florisil
Florisil®, a registered trade name of U. S. Silica Co., is a magnesium silicate with basic properties. ISOLUTE® Florisil is PR (pesticide residue) grade for optimum performance.

ISOLUTE® Alumina
ISOLUTE Alumina is a highly porous form of alumina oxide, available in three pH ranges (acidic, basic neutral) It is used to separate analytes from interfering compounds of differing chemical polarity.

ISOLUTE® Si (Silica Gel)
ISOLUTE Si is a polar sorbent with weakly acidic properties.

ISOLUTE® PSA/SAX
This blend of polar sorbents removes polar interferences and pigments prior to pesticide analysis.

‘Clean Up’ Workflow from Biotage

1. Homogenize samples and extract sample into suitable non-polar solvent

2. Manual or automated extraction and clean up of pesticides using polar ISOLUTE® SPE columns

3. Evaporate extracts to dryness and reconstitute for analysis

4. Analyze purified, concentrated extracts

Ordering Information

Sample Preparation Consumables

Part Number	Item Description	Qty
Acrylamide Analysis (EN16618:2015)		
904-0100-C	ISOLUTE® Multimode 1 g/6 mL	30
904-0050-B	ISOLUTE® Multimode 500 mg/3 mL	50
904-0100-P01	ISOLUTE® Multimode 100 mg plate	1
915-0050-C	ISOLUTE® ENV+ 500 mg/6 mL	30
915-0050-B	ISOLUTE® ENV+ 200 mg/3 mL	50
915-0040-P01	ISOLUTE® ENV+ 40 mg plate	1
Acrylamide Analysis (using supported liquid extraction)		
820-0140-C	ISOLUTE® SLE+ 1 mL columns	30
820-0140-CG	ISOLUTE® SLE+ 1 mL columns (Tabless)	30
Mycotoxin Analysis		
150-0006-BG	ISOLUTE® Myco 60 mg/3 mL (Tabless)	50
Pesticide Analysis (QuEChERS)		
Q0000-50V	ISOLUTE® QuEChERS 50 mL Centrifuge Tube With Rack	25
Q0010-15V	ISOLUTE® QuEChERS AOAC 15 g/15 mL Extraction Tube	25
Q0020-15V	ISOLUTE® QuEChERS EN 10 g/15 mL Extraction Tube	25
Q0030-15V	ISOLUTE® QuEChERS AOAC Fruit and Vegetables Clean up Tube	25
Q0035-15V	ISOLUTE® QuEChERS EN Fruit and Vegetables Clean up Tube	25
Q0050-15V	ISOLUTE® QuEChERS AOAC Waxed Fruit and Vegetables Clean up Tube	25
Q0060-15V	ISOLUTE® QuEChERS EN Waxed Fruit and Vegetables Clean up Tube	25
Q0070-15V	ISOLUTE® QuEChERS AOAC Pigmented Fruit and Vegetables Clean up Tube	25
Q0080-15V	ISOLUTE® QuEChERS EN Pigmented Fruit and Vegetables Clean up Tube	25
Q0090-15V	ISOLUTE® QuEChERS EN Highly Pigmented Fruit and Vegetables Clean up Tube	25
Pesticide Analysis (ISOLUTE® ENV+)		
915-0010-B	ISOLUTE® ENV+ 100 mg/3 mL	50
915-0010-BG	ISOLUTE® ENV+ 100 mg/3 mL (Tabless)	50
915-0010-C	ISOLUTE® ENV+ 100 mg/6 mL	30
915-0020-B	ISOLUTE® ENV+ 200 mg/3 mL	50
915-0020-C	ISOLUTE® ENV+ 200 mg/6 mL	30
915-0020-CG	ISOLUTE® ENV+ 200 mg/6 mL (Tabless)	30
915-0050-C	ISOLUTE® ENV+ 500 mg/6 mL	30

Part Number	Item Description	Qty
Extract Clean Up (Polar SPE columns)		
ISOLUTE® Florisil		
712-0050-B	ISOLUTE® FL 500 mg/3 mL	50
712-0100-B	ISOLUTE® FL 1 g/3 mL	50
712-0050-C	ISOLUTE® FL 500 mg/6 mL	30
712-0100-C	ISOLUTE® FL 1 g/6 mL	30
ISOLUTE® Alumina		
713-0050-B	ISOLUTE® AL-A 500 mg/3 mL	50
713-0100-C	ISOLUTE® AL-A 1 g/6 mL	30
714-0050-B	ISOLUTE® AL-N 500 mg/3 mL	50
714-0100-C	ISOLUTE® AL-N 1 g/6 mL	30
715-0050-B	ISOLUTE® AL-B 500 mg/3 mL	50
715-0100-C	ISOLUTE® AL-B 1 g/6 mL	30
ISOLUTE® Silica		
460-0050-B	ISOLUTE® SI 500 mg/3 mL	50
460-0100-B	ISOLUTE® SI 1 g/3 mL	50
460-0050-C	ISOLUTE® SI 500 mg/6 mL	30
460-0100-C	ISOLUTE® SI 1 g/6 mL	30
ISOLUTE PSA/SAX		
924-0100-C	ISOLUTE® PSA/SAX 1 g/6 mL	30
924-0200-C	ISOLUTE® PSA/SAX 2 g/6 mL	30

Other formats are available, contact your Biotage representative or visit www.biotage.com to discuss your requirements.

Systems

Part Number	Item Description	Qty
Homogenization		
19-060	Biotage® Lysera	1
Manual Vacuum Processing		
121-1012	Biotage® VacMaster™ 10 Sample Processing Station (With 12 mm Rack)	1
121-1015ML	Biotage® VacMaster™ 10 Sample Processing Station (With 15 mL Rack) * fits 10 x 15 mL centrifuge tubes	1
121-1016	Biotage® VacMaster™ 10 Sample Processing Station (With 16 mm Rack)	1
121-1027	Biotage® VacMaster™ 10 Sample Processing Station (With 27 mm Rack)	1
121-2012	Biotage® VacMaster™ 20 Sample Processing Station (With 12 mm Rack)	1
121-2015ML	Biotage® VacMaster™ 20 Sample Processing Station (With 15 mL Rack) * fits 20 x 15 mL centrifuge tubes	1
121-2016	Biotage® VacMaster™ 20 Sample Processing Station (With 16 mm Rack)	1
121-2000	Biotage® VacMaster™ 20 Sample Processing Station SPECIAL	1
121-9600	Biotage® VacMaster™-96 Sample processing Manifold	1
VMD-250	Biotage® VacMaster™ Disk	1
Automated Vacuum Processing		
SPE-DEX 5000	Biotage® Horizon 5000	1
Manual Positive Pressure Manifolds		
PPM-48	Biotage® PRESSURE+ 48 Positive Pressure Manifold	1
PPM-96	Biotage® PRESSURE+ 96 Positive Pressure Manifold	1
Automated Positive Pressure Processing		
414001	Biotage® Extrahera™ Classic	1
417002	Biotage® Extrahera™ HV-5000	1
Evaporation		
415000	TurboVap® LV	1
415001	TurboVap® II	1
418000	TurboVap® 96 Dual	1
415540	TurboVap® EH	1
415539	TurboVap® P+	1

Your Complete Partner for Effective Chemistry

Biotage is a worldwide supplier of instruments and accessories designed to facilitate the work of scientists in life sciences. With our deep knowledge of the industry, academic contacts and in-house R&D teams, we can deliver the best solutions to your challenges. We take great pride in our flexibility and ability to meet our customer's individual needs. With strong foundations in analytical, organic, process, and biomolecule chemistry, we can offer the widest range of solutions available on the market.

EUROPE
Main Office: +46 18 565900
Fax: +46 18 591922
Order Tel: +46 18 565710
Order Fax: +46 18 565705
order@biotage.com
Support Tel: +46 18 56 59 11
Support Fax: + 46 18 56 57 11
eu-1-pointsupport@biotage.com

NORTH & LATIN AMERICA
Main Office: +1 704 654 4900
Toll Free: +1 800 446 4752
Fax: +1 704 654 4917
Order Tel: +1 800 446 4752
Order Fax: +1 704 654 4917
ordermailbox@biotage.com
Support Tel: +1 800 446 4752
us-1-pointsupport@biotage.com

JAPAN
Tel: +81 3 5627 3123
Fax: +81 3 5627 3121
jp_order@biotage.com
jp-1-pointsupport@biotage.com

CHINA
Tel: +86 21 68162810
Fax: +86 21 68162829
cn_order@biotage.com
cn-1-pointsupport@biotage.com

KOREA
Tel: +82 31 706 8500
Fax: +82 31 706 8510
korea_info@biotage.com
kr-1-pointsupport@biotage.com

INDIA
Tel: +91 11 45653772
india@biotage.com

Distributors in other regions are listed on www.biotage.com

Literature Number: PPS684

© 2022 Biotage. All rights reserved. No material may be reproduced or published without the written permission of Biotage. Information in this document is subject to change without notice and does not represent any commitment from Biotage. E&OE. A list of all trademarks owned by Biotage AB is available at www.biotage.com/legal. Other product and company names mentioned herein may be trademarks or registered trademarks and/or service marks of their respective owners, and are used only for explanation and to the owners' benefit, without intent to infringe.

Biotage®