

SAMPLE PREPARATION



TABLE OF CONTENTS

Introduction	25	Certified Sep-Pak Solid-Phase Extraction (SPE) Cartridges ..	63
Sample Preparation	25	Improve Workflow and Reduce Solvent Waste	63
Oasis Solid-Phase Extraction (SPE) Products	26	Certified Sep-Pak Sorbent Selection Guide.....	64
A Breakthrough in SPE	26	Accessories	65
Oasis HLB for Reversed-Phase SPE.....	30	Waters Vaccum Manifold for Use with SPE Cartridges	65
Oasis MCX for Basic Compounds	32	Sep-Pak Cartridge Connections Kit.....	66
Oasis MAX for Acidic Compounds	33	Sep-Pak Cartridge Accessories	66
Therapeutic Peptide Method Development Kits.....	35	Waters Positive Pressure-96 Processor	66
Oasis WCX for Strong Basic Compounds	35	Ostro Pass-Through Sample Preparation Product	67
Oasis WAX for Strong Acidic Compounds	37	The Simplest Way to Cleaner Samples	67
Oasis 2x4 Methodology for Cartridge and Standard 96-well Plates	38	DisQuE Sample Preparation Solutions for QuEChERS	70
Oasis μ Elution 96-well Plates.....	41	DisQuE Kitted Solutions	70
Oasis 2x4 Method Proof of Concept for μ Elution Plates	42	DisQuE Extraction and Clean-up Tubes and Pouches.....	71
Oasis 96-well High Throughput Extraction Plates	45	Bulk Sorbents	71
Oasis On-Line Columns and Cartridges	46	PoraPak Rxn Cartridges for Post-Synthesis Cleanup	72
Oasis Bulk Sorbents	48	Cleanup of a Reductive Amination Mixture.....	73
Oasis Glass Cartridges for PPT Detection Levels	48	Removal of TFA from Reversed-Phase Prep-LC Fractions; Isolation of the Purified Free-Base Product	73
Environmental and Food Solution Kits	49	Waters/Pall Life Sciences Sample and Solvent Filtration Products	75
ACQUITY UPLC PFC Column Kit.....	49	Filter Design and Membrane Choices	76
ACQUITY UPLC PFC Analysis Kit	49		
ACQUITY UPLC Bisphenol A Column and Method Kits	49		
EPA Method 1694 Analysis Kit	49		
Soft Drink Analysis	50		
Choose Waters	50		
Soft Drink Analysis 4 Component Standard.....	50		
Soft Drink Analysis 5 Component Standard	50		
Sep-Pak Solid-Phase Extraction (SPE) Products	51		
The Most Referenced and Widely Used Sample Preparation Technology.....	51		
Sep-Pak Sorbent Selection Guide	52		
Sep-Pak Cartridge Selection Guide.....	54		
Anatomy of Sep-Pak Cartridges	56		
General Extraction Protocols for Sep-Pak Cartridges	57		
Sep-Pak DNPH-Silica Cartridges for Analyzing Formaldehyde, Other Aldehydes and Ketones in Air	59		
Ozone Scrubber Cartridges.....	61		
Sep-Pak XPoSure Aldehyde Sampler Cartridges for Monitoring Aldehydes in Indoor Air	61		
PoraPak RDX Sep-Pak Extraction Cartridge for the Analysis of Explosives in Surface and Ground Waters.....	62		
Sep-Pak Dry SPE Cartridge	62		

INTRODUCTION

Sample Preparation

The Importance of Sample Preparation

In the last two decades, dramatic advances in analytical instrumentation and laboratory information management systems shifted the analyst's predominant tasks from assay measurements to sample preparation and data processing. As the stringency of requirements for higher sensitivity, selectivity, accuracy, precision, and number of samples to be processed has escalated, the corresponding increases in speed and sophistication of analysis and data collection have outpaced improvements in the many traditional techniques of sample collection and preparation. By some estimates, 75–80% of the work activity and operating cost in a contemporary analytical lab is spent processing and preparing samples for introduction or injection into an analytical separation and/or measurement device. Clearly, efforts directed and products designed to streamline sample preparation protocols are essential to future progress in analytical science.

Goals of Sample Preparation

Successful sample preparation for most analytical techniques (HPLC, GC, Spectrophotometry, RIA, etc.) has a threefold objective—namely, to provide the sample component of interest:

- In solution
- Free from interfering matrix elements
- At a concentration appropriate for detection or measurement

Benefits of Solid-Phase Extraction (SPE)

When compared to other sample preparation processes, solid-phase extraction offer:

- Lower solvent consumption
- Greater recoveries
- Lower reagent consumption
- Less sample handling
- Less apparatus
- Faster protocol
- Fewer steps
- Less exposure to toxic agents
- Greater accuracy
- No cross contamination
- No emulsion problems
- Direct field sampling
- Reduced harm to labile samples
- Minimal evaporation
- Minimal glass breakage
- Less glassware used, less to wash
- Lower cost

OASIS SOLID-PHASE EXTRACTION (SPE) PRODUCTS



A Breakthrough in SPE

Introduction

In October 1977, Waters designed the first miniature cartridge columns (Sep-Pak® Cartridges) containing silica-based adsorbents for SPE.

Demands for sample preparation led to the development of a specially designed polymeric sorbent that performs optimally for reversed-phase SPE. The Oasis® HLB copolymer with unique Hydrophilic-Lipophilic Balance is unlike traditional SPE sorbents.

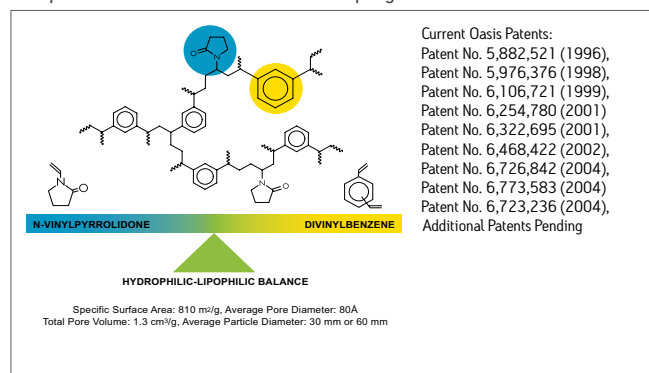
Today's goals for modern SPE are faster throughput, higher recovery and reproducibility, and stronger retention and selectivity. Now sample preparation is no longer a bottleneck to high-throughput techniques such as LC-MS/MS.

A Wide Selection of Oasis Chemistries

Oasis sorbents are available in 5 different SPE chemistries, providing a range of options for method development. The Oasis HLB Sorbent is a macroporous copolymer made from a balanced ratio of two monomers, the lipophilic divinylbenzene and the hydrophilic N-vinylpyrrolidone. It provides reversed-phase capability with a special "polar hook" for enhanced capture of polar analytes and excellent wettability.



Unique Water-Wettable Oasis HLB Copolymer



Oasis Product Selection Guide



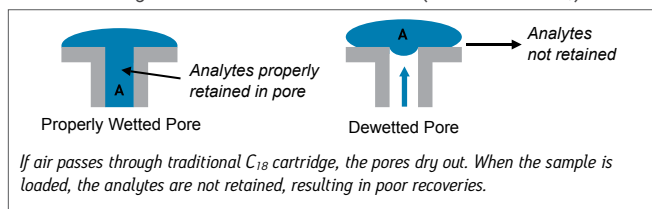
	1 cc/10 mg	1 cc/10 mg Flangeless	1 cc/30 mg	1 cc/30 mg Flangeless	1 cc/30 mg Gilson® Adapter	3 cc/60 mg	3 cc/60 mg Flangeless	3 cc/60 mg Gilson Adapter	3 cc/540 mg	3 cc/540 mg Flangeless	6 cc/150 mg
Sorbent	100/box	100/box	100/box	100/box	500/box	100/box	100/box	500/box	100/box	100/box	30/box
Oasis HLB 30 µm	186000383	186006339	WAT094225	186001879	WAT058882	WAT094226	186001880	WAT058883	—	—	186003365
Oasis HLB 60 µm	—	—	—	—	—	—	—	—	186004134	186003852	186003379
Oasis MCX 30 µm	186004648	186006340	186000252	186001881	186001888	186000254	186001882	—	—	—	186000256
Oasis MCX 60 µm	—	—	186000782	—	—	186000253	—	—	—	—	186000255
Oasis MAX 30 µm	186004649	186006341	186000366	186001883	—	186000367	186001884	—	—	—	186000369
Oasis MAX 60 µm	—	—	—	—	—	186000368	—	—	—	—	186000370
Oasis WCX 30 µm	186004650	186006342	186002494	186006499	—	186002495	186006501	—	—	—	186002498
Oasis WCX 60 µm	—	—	186002496	—	—	186002497	—	—	—	—	—
Oasis WAX 30 µm	186004651	186006343	186002489	186006500	—	186002490	186006502	—	—	—	186002493
Oasis WAX 60 µm	—	—	186002491	—	—	186002492	—	—	—	—	—

The other 4 Oasis chemistries—MCX, MAX, WCX, and WAX—are all derived from the Oasis HLB copolymer and feature a mixed-mode retention mechanism (both ion exchange and reversed phase), which can be manipulated very predictably for maximum selectivity and sensitivity.

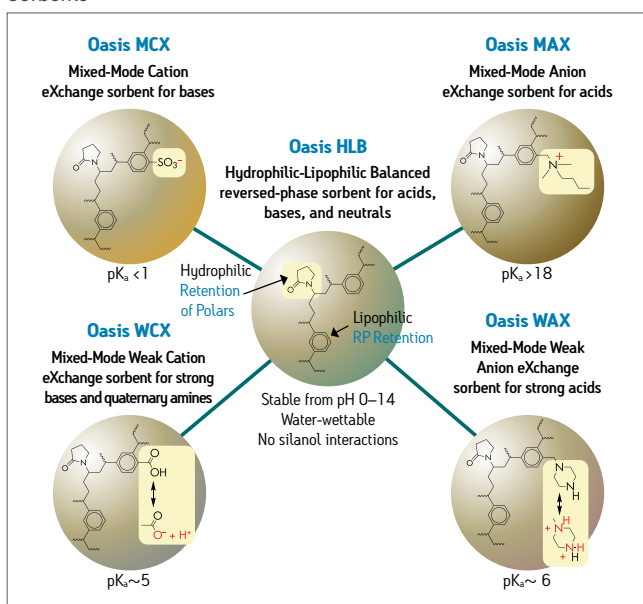
High and Consistent Recoveries

Oasis sorbents are water wettable, maintaining high retention and capacity for a wide spectrum of analytes, especially when the SPE Column runs dry. When the sorbent pores dry out, the chromatographic retention (capture) of the analytes is reduced, resulting in poor recovery. Traditional, silica-based C₁₈ sorbents can easily dry out, especially on a vacuum manifold if a particular cartridge flows quickly and allows air to be drawn in. Oasis Sorbents maintain proper wetting for more consistent performance (especially important for 96-well plates). Even if air passes through, the Oasis pores do not dry out.

Pore Dewetting Mechanism of Sorbent Pores (Silica-Based C₁₈)

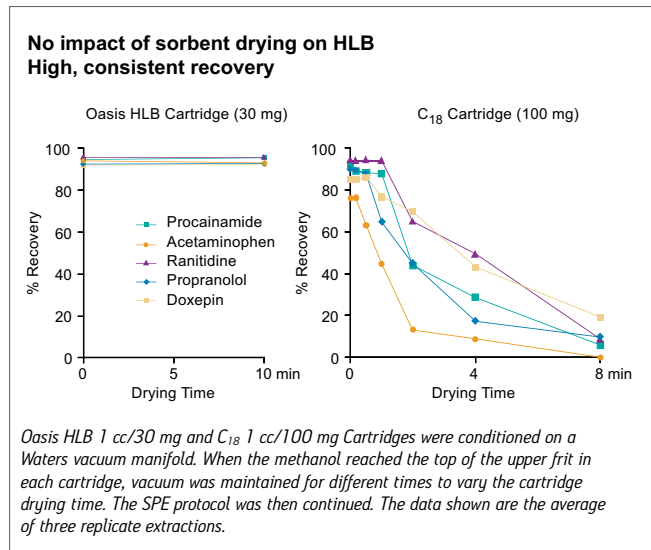


Sorbents



Sorbent	6 cc/200 mg 30/box	6 cc/400 mg Flangeless 100/box	6 cc/500 mg 30/box	12 cc/500 mg 20/box	20 cc/1 g 20/box	35 cc/6 g 10/box	Plus Short 225 mg 50/box	Plus Light 30 mg 50/box	Vac RC 30 mg 50/box	Vac RC 60 mg 50/box	Glass Cartridge 5 cc/200 mg 30/box
Oasis HLB 30 μm	WAT106202	—	—	—	—	—	—	186005125	186000382	186000381	—
Oasis HLB 60 μm	—	—	186000115	186000116	186000117	186000118	186000132	—	—	—	186000683
Oasis MCX 30 μm	—	186001216	—	—	—	—	—	—	—	186000261	—
Oasis MCX 60 μm	—	—	186000776	—	186000777	186000778	186003516	—	—	186000380	—
Oasis MAX 30 μm	—	186001855	—	—	—	—	—	—	186000372	186000371	—
Oasis MAX 60 μm	—	—	186000865	—	—	—	186003517	—	—	186000378	—
Oasis WCX 30 μm	—	—	—	—	—	—	—	—	—	—	—
Oasis WCX 60 μm	—	—	186004646	—	—	—	186003518	—	—	—	—
Oasis WAX 30 μm	—	—	—	—	—	—	—	—	—	—	—
Oasis WAX 60 μm	—	—	186004647	—	—	—	186003519	—	—	—	—

Effect of Drying on Recovery—Oasis HLB Versus C₁₈ Sorbents



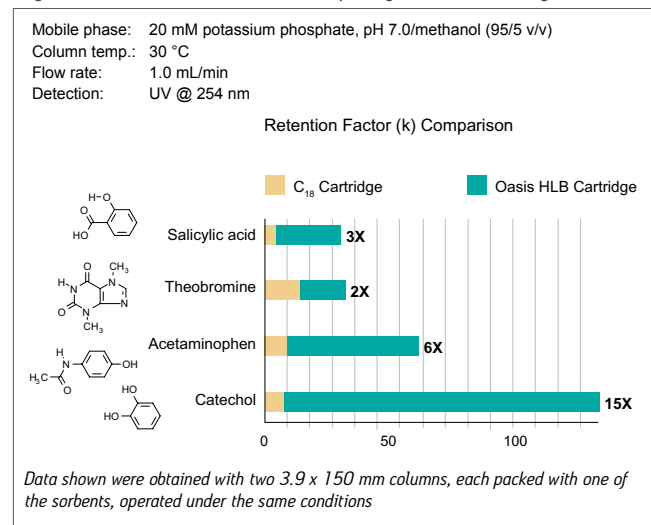
The variable recoveries seen with the C₁₈ sorbents, due to the drying out effect, are often the cause for “retests”, reducing laboratory productivity. In some laboratories, 10% of samples are retests—this can be reduced using Oasis Sorbents.

Also, Oasis Sorbents retain polar compounds far better than bonded silica SPE sorbents. Note the poor recovery of the polar analyte Acetaminophen on C₁₈. Oasis Sorbents work especially well when you need to capture metabolites (see figure on the right).

High Capacity Using Less Sorbent

When transferring methods from a C₁₈-bonded phase to Oasis Products, keep in mind the greater capacity of the Oasis Sorbent. The Oasis Sorbent has 2–3x more surface area and shows a dramatic increase in k values compared to silica-based C₁₈. This reduces breakthrough potential. In addition, you may be able to use 2/3 less sorbent than you would with C₁₈ (30 mg of Oasis HLB gives equivalent capacity to 100 mg of C₁₈).

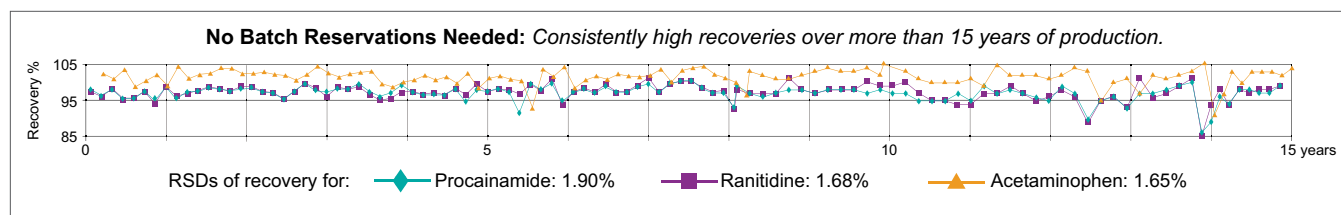
Higher Retention Means Greater Capacity, No Breakthrough



Exceptional Batch-to-Batch Reproducibility

Because of poor stability at pH extremes and relatively low ionic capacity, traditional silica-based, mixed-mode sorbents don't have long term, batch-to-batch reproducibility and, therefore, require reservations of specific lots of sorbent for large projects. Oasis Sorbents have demonstrated excellent long-term, batch-to-batch reproducibility for over 15 years. As a result of careful process design and stringent quality controls, a new standard has been set in batch-to-batch and lot-to-lot reproducibility for SPE sorbents. The Oasis family of sorbents and devices are manufactured in a Waters ISO 9001-registered facility in compliance with cGMP guidelines of the U.S. Food and Drug Administration for class 1 medical devices. Multiple batches of each Oasis chemistry have been successfully used on validated bioanalytical assays in a regulated laboratory environment.

Batch-to-Batch Reproducibility of Oasis HLB Sorbent



Oasis SPE Device Formats

Oasis Products come in a full range of device formats to meet your SPE requirements— μ Elution plates, on-line columns, 96-well plates, and single-use cartridges.

Sorbent Amount and Solvent Selection for the Generic SPE Method

The suggested amount of sorbent in a cartridge or a plate required for your application is given in the table below. Remember, because of the increased capacity of the Oasis Sorbents, you can use less sorbent than you would normally need if you used a silica-based packing. When converting from C_{18} silica-based sorbents to Oasis SPE Sorbents, use approximately 2/3 less Oasis Sorbent (100 mg C_{18} Sorbent = 30 mg Oasis Sorbent).

Select the solvent used for the elution step based on the polarity of the analyte. The table below gives a selection of elution solvents and each solvent gives you different selectivity and elution strength.

Capacity and Elution Volume of Oasis 96-well Plates and Cartridges

Sorbent Per Device	Maximum Mass Capacity	Typical Sample Volumes	Elution Volume
2 mg (μ Elution Plate)*	60–400 μ g	10–375 μ L	25 μ L**
5 mg*	0.15–1 mg	10–100 μ L	\leq 150 μ L
10 mg	0.35–2 mg	50–200 μ L	\leq 250 μ L
30 mg	1–5 mg	100 μ L–1 mL	\geq 400 μ L
60 mg	2–10 mg	200 μ L–2 mL	\geq 800 μ L

* Available only in 96-well plate formats

** μ Elution Plate requires no evaporation step

Tips for Selecting Elution Solvents for the Generic SPE Method (1-D)[†] The elution solvent is selected based on polarity of analyte.

Solvent	Solvent Type	Relative Elution Strength ^{††}	Comments
Methanol	proton donor	1.0	disrupts H-bonding
Acetonitrile	dipole-dipole	3.1	medium polarity drugs
Tetrahydrofuran	dipole-dipole	3.7	medium polarity drugs
Acetone	dipole-dipole	8.8	medium polarity drugs
Ethyl Acetate	dipole-dipole	high	nonpolar drugs and GC compatible
Methylene Chloride	dipole-dipole	high	nonpolar drugs and GC compatible

[†]When using solvents other than methanol, add 10–30% (of proton donor solvent such as methanol) to disrupt H-bonding on the Oasis HLB sorbent.

^{††}High-Purity Solvent Guide. Burdick and Jackson Laboratories, Inc. Solvent Properties of Common Liquids, L.R. Snyder, J. Chromatogr., 92, 223 (1974); J. Chromatogr. Sci. 16, 223 (1978).

Tips for Selecting the Appropriate Particle Size

Oasis Cartridges and Plates are available in two particle sizes (60 µm or 30 µm), allowing you to select the appropriate product based on the viscosity and turbidity of your sample. For extraction of most plasma, serum, and human urine, choose the 30 µm sorbent. For more viscous samples such as animal urine, excellent flow can be achieved using the 60 µm sorbent in either cartridges or plates.

Sample	30 µm	60 µm
Plasma	✓	
Serum	✓	
Whole Blood		
- cadaver		✓
- dog	✓	✓
- horse		✓

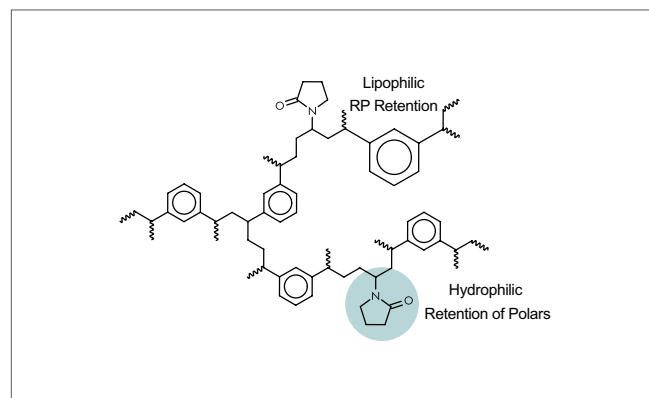
Automation of Oasis Sample Extraction Cartridges and 96-well Plates

Oasis SPE Products are compatible with the following liquid handling and/or SPE automation systems:

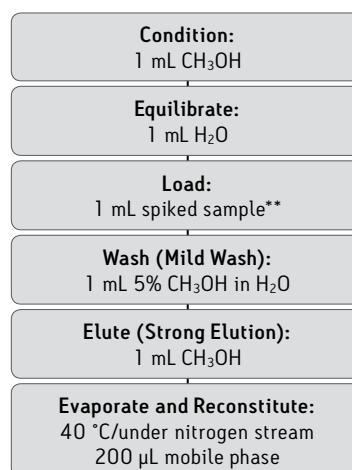
- Perkin Elmer® Robotic liquid handling system, MultiProbe® II
- Tomtec® Quadra4™ and Quadra4SPE™
- Hamilton® Microlab™ SPE Workstation
- Beckman® Biomek 2000 Laboratory Automation Workstation
- Caliper Life Science® RapidTrace™ Automated SPE Workstation, AutoTrace
- Gilson ASPEC XL4
- Gilson ASPEC XL
- Gilson 215 SPE Liquid Handler
- Tecan® Genesis™ FE500
- Spark Holland® Symbiosis™/Prospekt-2™

Oasis HLB for Reversed-Phase SPE

Oasis HLB (Hydrophilic-Lipophilic Balance) sorbent makes it fast and easy to develop sample preparation methods that deliver high, reproducible recoveries especially suited to LC-MS/MS analysis by providing the required selectivity and sensitivity.



Recommended Generic Oasis HLB SPE Method (1-D)*



* Volumes are given for the Oasis HLB 1 cc/30 mg Cartridge

** Add 20 µL (H₃PO₄) to disrupt drug-protein interaction/binding

Did you know...

You can eliminate the conditioning and Equilibration step, since Oasis has the unique water wettable capability.

Waters Regulated Bioanalysis System Solution

The Waters Regulated Bioanalysis System Solution enables the bioanalyst to combine workflow-driven analysis and compliant-ready data acquisition, management, and reporting with best-in-class sample preparation, UPLC, and tandem quadrupole MS. It's the world's first platform to deliver the ultimate performance for bioanalytical laboratories today, as it prepares your laboratory to evolve with the next frontier in bioanalytical sciences.

www.waters.com/bioanalysis



A Simple and Fast Generic SPE Reversed-Phase Protocol for Rapid Method Development for a Wide Range of Compounds (1-D)

Limitations of traditional silica-based sorbents make you evaluate several different bonded phases and brands to obtain acceptable results. With Oasis HLB, acidic, basic, and neutral compounds, whether polar or nonpolar, can be isolated reproducibly (RSDs <5%) with high recovery (>85%), using the same simple SPE protocol (see below).

This generic, 1-D method (1-Dimensional—only the organic strength is changed) has proven useful for a wide variety of compound types and may be the only protocol required, reducing method development time.

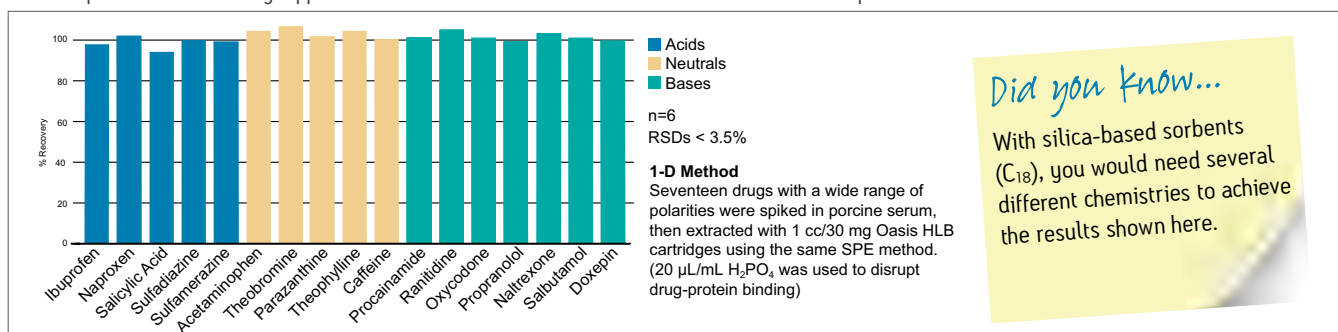
Did you know...

Sample Pretreatment Suggestion

Applying one or more of the following steps before loading your sample may improve your results:

1. Dilute sample 1:1 with buffer to improve flow during loading
2. Dilute 1:1 or greater with 0.1 N HCl or other acids
3. Filter through 0.45 μm membrane
4. Centrifuge @ ≥ 3000 rpm

One Simple Procedure: Many Applications on a Universal Sorbent—Reduced Method Development Time



Oasis HLB Sample Extraction Products

Description	Format	Particle Size	Qty.	Part No.
Oasis HLB Cartridge	1 cc/10 mg	30 μm	100/box	186000383
Oasis HLB Cartridge	1 cc/30 mg	30 μm	100/box	WAT094225
Oasis HLB Cartridge	1 cc/30 mg	30 μm	1,000/box	186003908
Oasis HLB Flangeless Cartridge	1 cc/30 mg	30 μm	100/box	186001879
Oasis HLB Cartridge with Gilson ASPEC adapter	1 cc/10 mg	30 μm	500/box	186000988
Oasis HLB Cartridge with Gilson ASPEC adapter	1 cc/30 mg	30 μm	500/box	WAT058882
Oasis HLB Cartridge	3 cc/60 mg	30 μm	100/box	WAT094226
Oasis HLB Cartridge	3 cc/60 mg	30 μm	1,000/box	186007646
Oasis HLB Flangeless Cartridge	3 cc/60 mg	30 μm	100/box	186001880
Oasis HLB Cartridge with Gilson ASPEC adapter	3 cc/60 mg	30 μm	500/box	WAT058883
Oasis HLB Cartridge	6 cc/200 mg	30 μm	30/box	WAT106202
Oasis HLB Cartridge	3 cc/400 mg	60 μm	100/box	186003849
Oasis HLB Cartridge	3 cc/540 mg	60 μm	100/box	186004134
Oasis HLB Flangeless Cartridge	3 cc/540 mg	60 μm	100/box	186003852
Oasis HLB Cartridge	6 cc/150 mg	30 μm	30/box	186003365
Oasis HLB Cartridge	6 cc/150 mg	60 μm	30/box	186003379
Oasis HLB Cartridge	6 cc/500 mg	60 μm	30/box	186000115
Oasis HLB Cartridge	12 cc/500 mg	60 μm	20/box	186000116
Oasis HLB Cartridge	20 cc/1 g	60 μm	20/box	186000117
Oasis HLB Cartridge	35 cc/6 g	60 μm	10/box	186000118
Oasis HLB Plus Short Cartridge	225 mg	60 μm	50/box	186000132
Oasis HLB Plus Light Cartridge	30 mg	30 μm	50/box	186005125
Oasis HLB Vac RC Cartridge	20 cc/30 mg	30 μm	50/box	186000382
Oasis HLB Vac RC Cartridge	20 cc/60 mg	30 μm	50/box	186000381
Oasis HLB Glass Cartridge	5 cc/200 mg	60 μm	30/box	186000683
Oasis HLB μ Elution Plate	2 mg/96-well	30 μm	1/pk	186001828BA
Oasis HLB Plate	5 mg/96-well	30 μm	1/pk	186000309
Oasis HLB Plate	10 mg/96-well	30 μm	1/pk	186000128
Oasis HLB Plate	30 mg/96-well	30 μm	1/pk	WAT058951
Oasis HLB Plate	60 mg/96-well	60 μm	1/pk	186000679

Oasis MCX for Basic Compounds

Obtain selective retention of basic drugs with cation-exchange groups on the sorbent surface. The Oasis MCX (Mixed-mode Cation eXchange) sorbent has a tightly controlled ion-exchange capacity (1 meq/g). There are no silanol groups to complicate the retention mode or method development. This novel, water-wettable, polymeric sorbent is stable from pH 0–14, making method development simple and fast.

Since this ion-exchange sorbent is synthesized from the reversed-phase Oasis HLB copolymer, it features two retention mechanisms (cation exchange and reversed phase), which can be manipulated very predictably (refer to the Oasis MCX Retention Map).

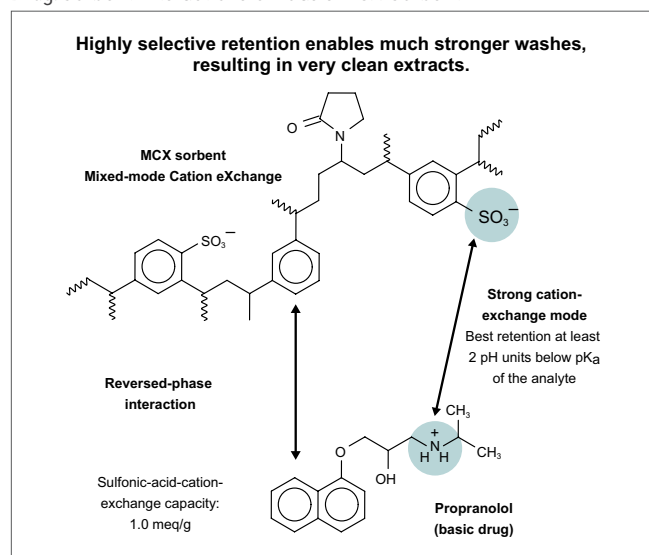
This retention map plots the total k or capacity (retention) of a basic analyte relative to pH. Note that the total k is the sum of the two retention mechanisms. At low pH, the analyte is charged and experiences maximum retention primarily from the ion-exchange mechanism, however, there is also a slight amount of reversed-phase contribution for the combined retention. If your goal is to capture basic analytes and then wash out interferences aggressively, the load and wash steps should be at low pH to obtain maximum capture.

At high pH, the ion-exchange retention mechanism shuts off because the analyte becomes unionized. Only reversed-phase retention is present, but since the analyte is now un-ionized, we get the maximum reversed-phase retention. We can elute with a combination of high pH and high organic concentration.

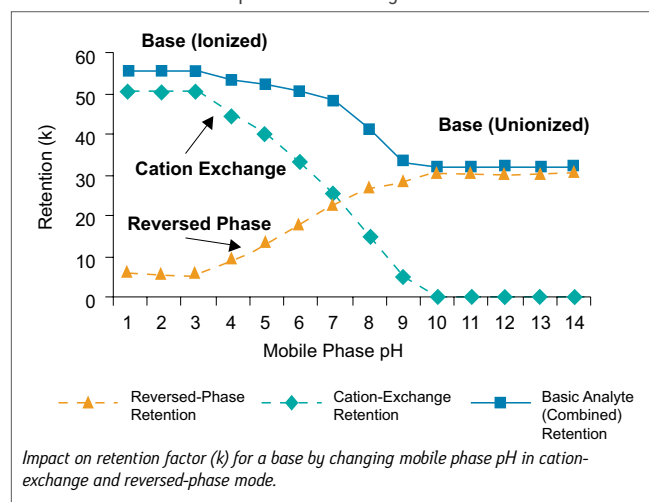
Oasis MCX Sample Extraction Products (Cation Exchange)

Description	Format	Particle Size	Qty.	Part No.
Oasis MCX Cartridge	1 cc/10 mg	30 μ m	100/box	186004648
Oasis MCX Cartridge	1 cc/30 mg	30 μ m	100/box	186000252
Oasis MCX Flangeless Cartridge	1 cc/30 mg	30 μ m	100/box	186001881
Oasis MCX Cartridge	1 cc/30 mg	60 μ m	100/box	186000782
Oasis MCX Cartridge	3 cc/60 mg	30 μ m	100/box	186000254
Oasis MCX Flangeless Cartridge	3 cc/60 mg	30 μ m	100/box	186001882
Oasis MCX Cartridge	3 cc/60 mg	60 μ m	100/box	186000253
Oasis MCX Cartridge	6 cc/150 mg	30 μ m	30/box	186000256
Oasis MCX Cartridge	6 cc/150 mg	60 μ m	30/box	186000255
Oasis MCX Cartridge	6 cc/500 mg	60 μ m	30/box	186000776
Oasis MCX Cartridge	20 cc/1 g	60 μ m	20/box	186000777
Oasis MCX Cartridge	35 cc/6 g	60 μ m	10/box	186000778
Oasis MCX Plus Short Cartridge	225 mg	60 μ m	50/box	186003516
Oasis MCX Vac RC Cartridge	20 cc/60 mg	30 μ m	50/box	186000261
Oasis MCX Vac RC Cartridge	20 cc/60 mg	60 μ m	50/box	186000380
Oasis MCX μ Elution Plate	2 mg/96-well	30 μ m	1/pk	186001830BA
Oasis MCX Plate	10 mg/96-well	30 μ m	1/pk	186000259
Oasis MCX Plate	30 mg/96-well	30 μ m	1/pk	186000248
Oasis MCX Plate	30 mg/96-well	60 μ m	1/pk	186000250
Oasis MCX Plate	60 mg/96-well	60 μ m	1/pk	186000678

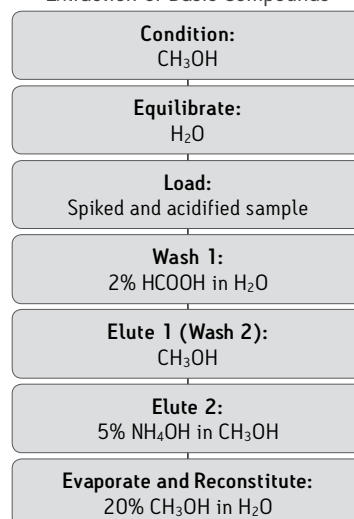
Drug/Sorbent Interactions on Oasis MCX Sorbent



Oasis MCX Retention Map for Basic Analytes



Generic Oasis MCX Method for Extraction of Basic Compounds



Did you know...

Waters has developed an online Oasis Method Development Tool for sample preparation

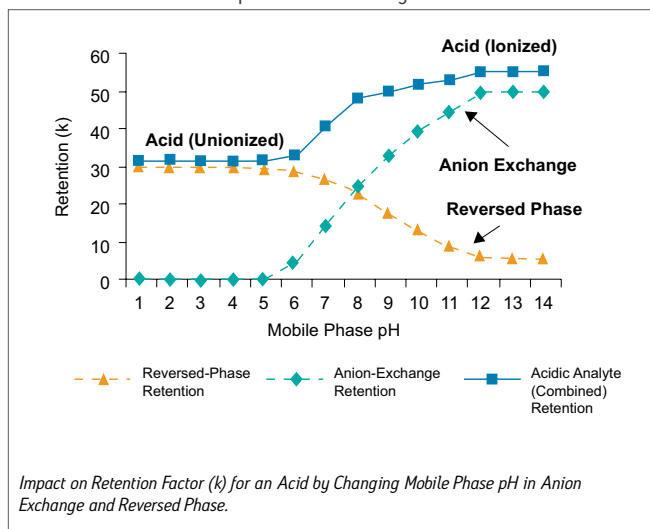
www.waters.com/mdtools

Oasis MAX for Acidic Compounds

The Oasis MAX (Mixed-mode Anion eXchange) sorbent has a tightly controlled ion-exchange capacity of 0.25 meq/g, ensuring reproducible SPE protocols for extraction of acidic compounds and metabolites from biological fluids. There are no silanol groups to complicate the retention mode or method development. This novel, water-wettable, polymeric sorbent is stable from pH 0–14, making method development simple and fast.

Since this ion-exchange sorbent is synthesized from the reversed-phase Oasis HLB copolymer, it features two retention mechanisms (anion exchange and reversed phase), which can be manipulated very predictably (please refer to the Oasis MAX Retention Map).

Oasis MAX Retention Map for Acidic Analytes



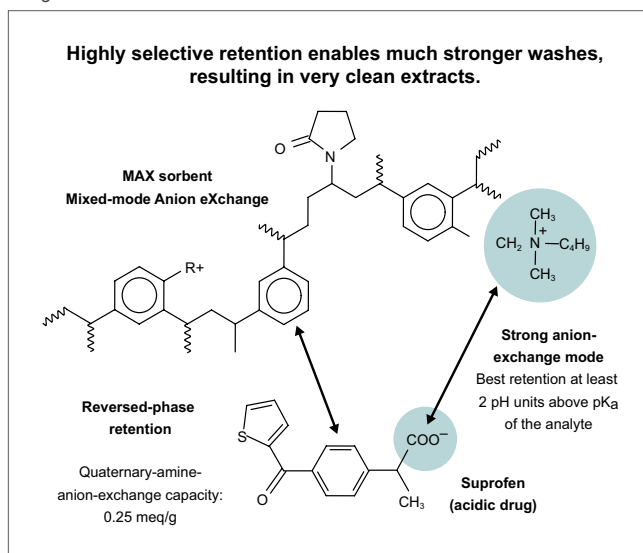
The retention map plots the total *k* or capacity (retention) of an acidic analyte relative to pH. Note that the total *k* is the sum of the two retention mechanisms. At high pH, the analyte is charged and experiences maximum retention primarily from the ion-exchange mechanism, however, there is also a slight amount of reversed-phase contribution for the combined retention. If your goal is to capture acidic analytes and then wash out interferences aggressively, the load and wash steps should be at high pH to obtain maximum capture.

Did you know...

When compared to other sample preparation techniques, SPE offers:

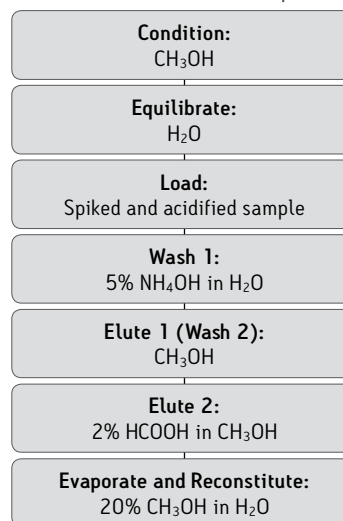
- Faster sample prep
- Lower cost
- Greater recoveries
- Greater accuracy
- Powerful enrichment of analytes
- Additional selectivity and specificity

Drug/Sorbent Interactions on Oasis MAX Sorbent



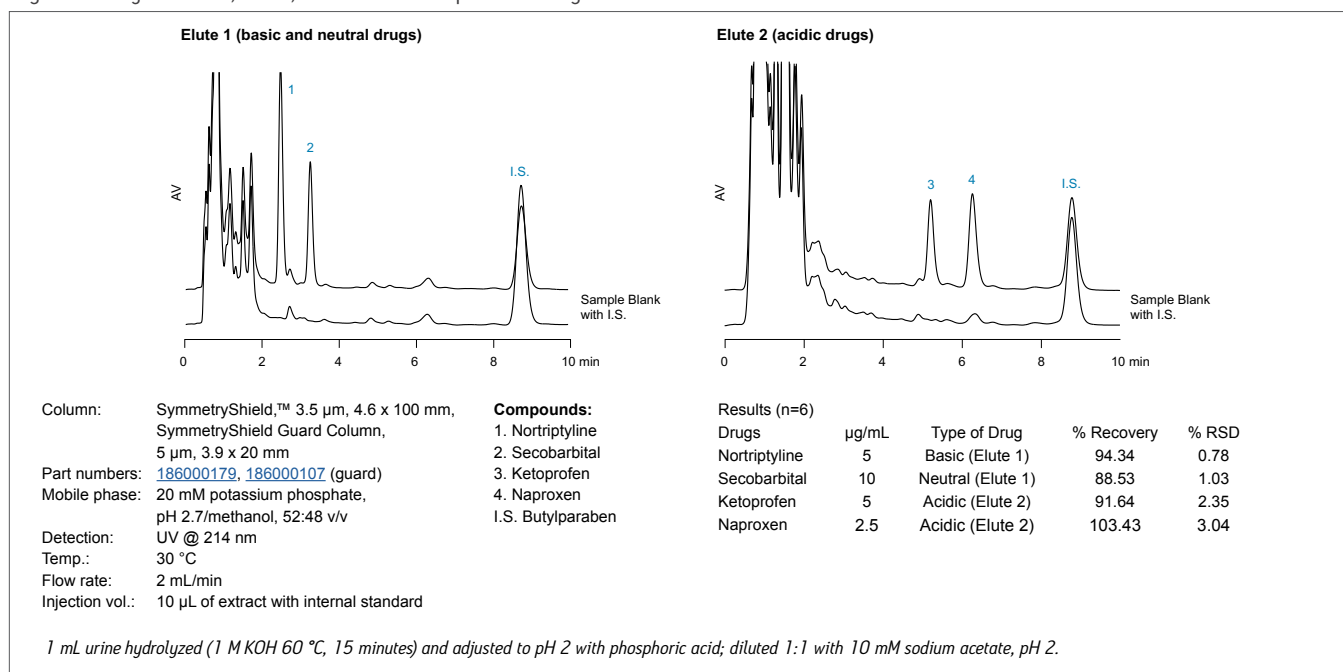
At low pH, the ion-exchange retention mechanism shut-off because the analyte becomes un-ionized. Only reversed-phase retention is present, but since the analyte is now un-ionized, we get the maximum reversed-phase retention. We can elute with a combination of low pH and high organic concentration.

Generic Oasis MAX Method for Extraction of Acidic Compounds



As shown on the [next page](#), acidic compounds can be separated from basic and neutral compounds on the same Oasis MAX Cartridge following the recommended protocol.

High Recovery of Acidic, Basic, and Neutral Compounds Using the Generic Oasis MAX Method



Oasis MAX Sample Extraction Products (Anion Exchange)

Description	Format	Particle Size	Qty.	Part No.
Oasis MAX Cartridge	1 cc/10 mg	30 µm	100/box	186004649
Oasis MAX Cartridge	1 cc/30 mg	30 µm	100/box	186000366
Oasis MAX Flangeless Cartridge	1 cc/30 mg	30 µm	100/box	186001883
Oasis MAX Cartridge	3 cc/60 mg	30 µm	100/box	186000367
Oasis MAX Cartridge	3 cc/60 mg	60 µm	100/box	186000368
Oasis MAX Flangeless Cartridge	3 cc/60 mg	30 µm	100/box	186001884
Oasis MAX Cartridge	6 cc/150 mg	30 µm	30/box	186000369
Oasis MAX Cartridge	6 cc/150 mg	60 µm	30/box	186000370
Oasis MAX Cartridge	6 cc/500 mg	60 µm	30/box	186000865
Oasis MAX Plus Short Cartridge	225 mg	60 µm	50/box	186003517
Oasis MAX Vac RC Cartridge	20 cc/30 mg	30 µm	50/box	186000372
Oasis MAX Vac RC Cartridge	20 cc/60 mg	30 µm	50/box	186000371
Oasis MAX Vac RC Cartridge	20 cc/60 mg	60 µm	50/box	186000378
Oasis MAX µElution Plate	2 mg/96-well	30 µm	1/pk	186001829
Oasis MAX Plate	10 mg/96-well	30 µm	1/pk	186000375
Oasis MAX Plate	30 mg/96-well	30 µm	1/pk	186000373
Oasis MAX Plate	60 mg/96-well	30 µm	1/pk	186001256
Oasis MAX Plate	60 mg/96-well	60 µm	1/pk	186001205

Therapeutic Peptide Method Development Kits

The Therapeutic Peptide Method Development Kits have been developed to simplify the process of sample preparation and LC method development for the analysis of therapeutic peptides in plasma. The kits contain an Oasis Peptide μ Elution Method Development Plate, a 1.7 μm or 3.5 μm BEH C_{18} , 300 \AA , 2.1 x 50 mm reversed-phase column, collection plates, cap mats, and the detailed screening protocol.



Therapeutic Peptide Method Development Kits

Description	Part No.
UPLC Therapeutic Peptide Method Development Kit Includes:	
1 Oasis Peptide Method Development 96-well μ Elution Plate, (part no.: 186004713)	176001835
1 ACQUITY UPLC Peptide BEH C_{18} , 300 \AA , 1.7 μm , 2.1 x 50 mm Column, (part no.: 186003685)	176001835
3 96-well 1 mL Collection Plate and Cap Mat, (part no.: 600001043)	
HPLC Therapeutic Peptide Method Development Kit Includes:	
1 Oasis Peptide Method Development 96-well μ Elution Plate, (part no.: 186004713)	176001836
1 XBridge Peptide BEH C_{18} , 300 \AA , 3.5 μm , 2.1 x 50 mm Column, (part no.: 186003607)	176001836
3 96-well 1 mL Collection Plate and Cap Mat, (part no.: 600001043)	

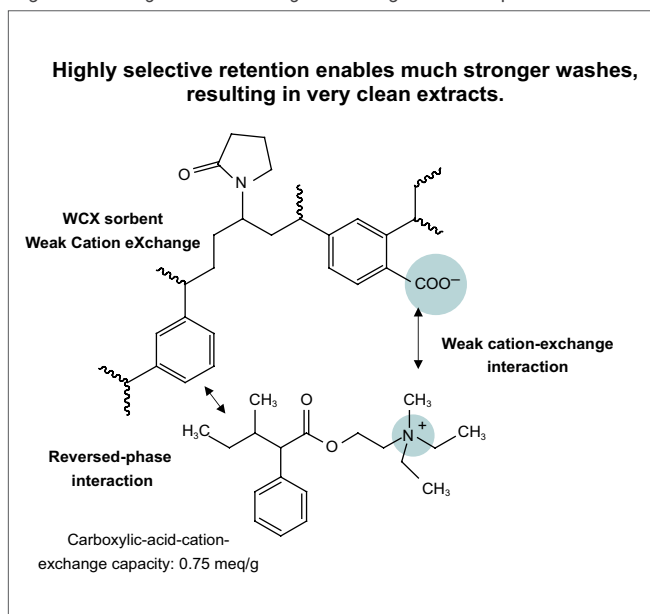
Did you know...

You can reduce non specific binding as well as sample loss, when working with therapeutic peptides, on microelution plates.

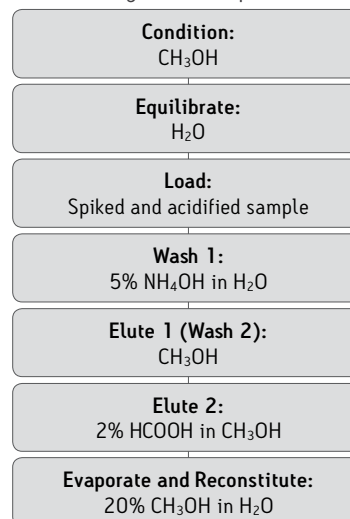
Oasis WCX for Strong Basic Compounds

The Oasis WCX (Weak Cation eXchange) SPE material was developed to provide better sample preparation for strong bases and quaternary amines. The retention mechanism is mixed mode (both ion exchange and reversed phase), which improves retention for all types of basic analytes, especially strong bases.

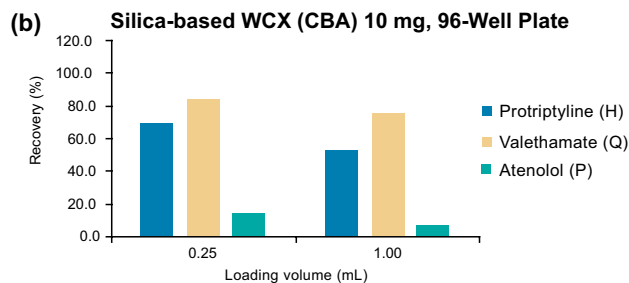
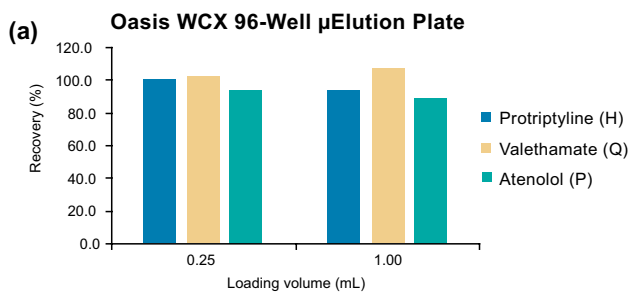
High Selectivity and Sensitivity for Strong Basic Compounds



Generic Oasis WCX Method for Strong Basic Compounds



Recovery Data for Three Basic Compounds from Oasis WCX vs. Silica-Based WCX Products

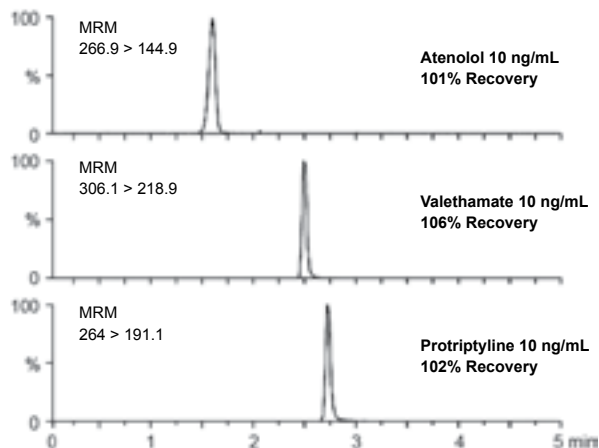


SPE recoveries for three types of bases versus volume of spiked saline solution loaded onto (a) the Oasis WCX Sorbent and (b) a commercially available silica-based WCX sorbent. H is hydrophobic base, Q is quaternary amine, and P is polar base.

Excellent Recovery for Quaternary Amines as well as Polar and Hydrophobic Bases

Column: XTerra[®] MS C₁₈ IS[™] 3.5 μ m, 2.1 x 20 mm
 Part number: [186001923](#)
 Mobile phase A: 10 mM NH₄HCO₃, pH 10
 Mobile phase B: MeOH with 10 mM NH₄HCO₃, pH 10
 Gradient: 5 to 95% B in 3 min
 Flow rate: 0.4 mL/min
 Injection vol.: 10 μ L

Instruments:
 Waters 2777 Sample Manager, and Waters 1525 μ binary HPLC pump, Waters Quattro Ultima (ESI in MRM)



LC-MS/MS chromatograms of the analytes (polar base, quaternary amine, and hydrophobic base) extracted from rat plasma with Oasis WCX 96-well μ Elution Plate. The SPE recoveries were calculated by comparison with postextracted spiked plasma samples.

Oasis WCX Sample Extraction Products (Weak Cation Exchange)

Description	Format	Particle Size	Qty.	Part No.
Oasis WCX Cartridge	1 cc/10 mg	30 μ m	100/box	186004650
Oasis WCX Cartridge	1 cc/30 mg	30 μ m	100/box	186002494
Oasis WCX Cartridge	3 cc/60 mg	30 μ m	100/box	186002495
Oasis WCX Cartridge	6 cc/150 mg	30 μ m	30/box	186002498
Oasis WCX Cartridge	1 cc/30 mg	60 μ m	100/box	186002496
Oasis WCX Cartridge	3 cc/60 mg	60 μ m	100/box	186002497
Oasis WCX Cartridge	6 cc/500 mg	60 μ m	30/box	186004646
Oasis WCX Plus Short Cartridge	225 mg	60 μ m	50/box	186003518
Oasis WCX μ Elution Plate	2 mg/96-well	30 μ m	1/pk	186002499
Oasis WCX 96-well Plate	10 mg/96-well	30 μ m	1/pk	186002501
Oasis WCX 96-well Plate	30 mg/96-well	30 μ m	1/pk	186002503

Oasis WAX for Strong Acidic Compounds

The Oasis WAX (Weak Anion eXchange) SPE material was developed to provide sample preparation for strong acidic compounds. The retention mechanism is mixed mode (both ion exchange and reversed phase), which improves retention for strong acidic compounds.

High Selectivity and Sensitivity for Strong Acidic Compounds

Highly selective retention enables much stronger washes, resulting in very clean extracts.

WAX sorbent Weak Anion eXchange

Reversed-phase interaction

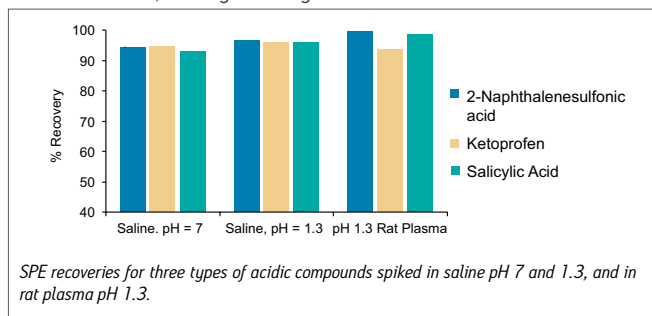
Weak anion-exchange interaction

Piperazine-anion-exchange capacity: 0.6 meq/g

Generic Oasis WAX Method for Strong Acidic Compounds

Condition: CH ₃ OH
Equilibrate: H ₂ O
Load: Spiked and acidified sample
Wash 1: 2% HCOOH in H ₂ O
Elute 1 (Wash 2): CH ₃ OH
Elute 2: 5% NH ₄ OH in CH ₃ OH
Evaporate and Reconstitute: 20% CH ₃ OH in H ₂ O

Recovery Data for Three Acidic Compounds from Oasis WAX 1 cc, 30 mg Cartridge



Excellent Recovery for a Strong Acid: Camphorsulfonic Acid

HPLC Conditions:
 Column: SunFire C₁₈ IS, 3.5 μm, 2.1 x 20 mm
 Instrument: Waters 2777 Sample Manager, Waters 1525μ Binary HPLC Pump and Waters Quattro Premier™
 Part number: [186002531](#)
 Mobile phase A: H₂O with 10 mM CH₃COO-NH₄⁺, pH 7
 Mobile phase B: MeOH with 10 mM CH₃COO-NH₄⁺, pH 7
 Flow rate: 0.4 mL/min
 Gradient:

Time (min)	%A	%B
0.0	95	5
3.0	5	95
4.0	5	95
4.1	95	5
5.0	95	5

 Injection vol.: 10 μL
 Temp.: Ambient

MS/MS Conditions:
 System: Quattro Premier
 Ionization mode: ESI-
 Source temp.: 150 °C
 Desolvation temp.: 350 °C
 Cone gas flow: 50 L/Hr
 Desolvation gas flow: 600 L/Hr
 Collision Cell: 2.2e³ bar (Ar gas)

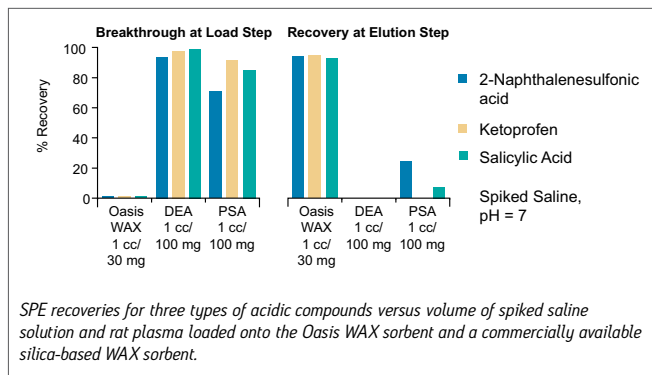
MRM Transition **Cone (V)** **CID (eV)**
 m/z 231.1 _ 79.8 60 30

(1S)-Camphor-10-sulfonic acid
 MW 232.3, C₁₀H₁₆O₄S

Concentration: 10 pg/μL
 108.8% recovery

Concentration: 50 pg/μL
 114.4% recovery

Recovery Data of Three Acidic Compounds for Oasis WAX vs. Silica-Based WAX Products



Oasis WAX Sample Extraction Products (Weak Anion Exchange)

Description	Format	Particle Size	Qty.	Part No.
Oasis WAX Cartridge	1 cc/10 mg	30 µm	100/box	186004651
Oasis WAX Cartridge	1 cc/30 mg	30 µm	100/box	186002489
Oasis WAX Cartridge	3 cc/60 mg	30 µm	100/box	186002490
Oasis WAX Cartridge	6 cc/150 mg	30 µm	30/box	186002493
Oasis WAX Cartridge	1 cc/30 mg	60 µm	100/box	186002491
Oasis WAX Cartridge	3 cc/60 mg	60 µm	100/box	186002492
Oasis WAX Cartridge	6 cc/500 mg	60 µm	30/box	186004647
Oasis WAX Plus Cartridge	225 mg	60 µm	50/box	186003519
Oasis WAX µElution Plate	2 mg/96-well	30 µm	1/pk	186002500
Oasis WAX 96-well Plate	10 mg/96-well	30 µm	1/pk	186002502
Oasis WAX 96-well Plate	30 mg/96-well	30 µm	1/pk	186002504
Oasis WAX 96-well Plate	60 mg	30 µm	1/pk	186003915

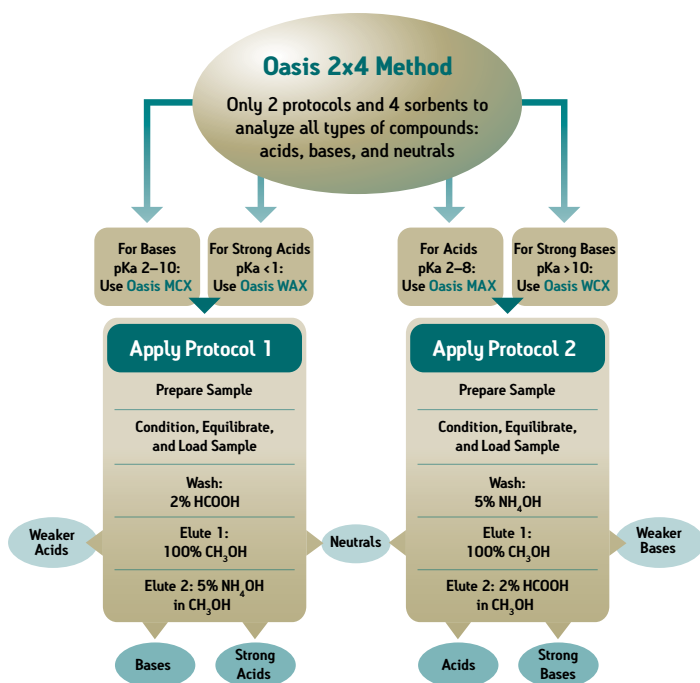
Oasis 2x4 Methodology for Cartridge and Standard 96-well Plates

The Oasis 2x4 Method is a simple, logical approach to the selection of an SPE sorbent and protocol. Two protocols and four sorbents provide the flexibility to extract acids, bases, and neutrals with high recoveries while removing matrix components that may interfere with analysis.

Follow the simple steps outlined in this flow chart to achieve high recoveries and the cleanest extracts:

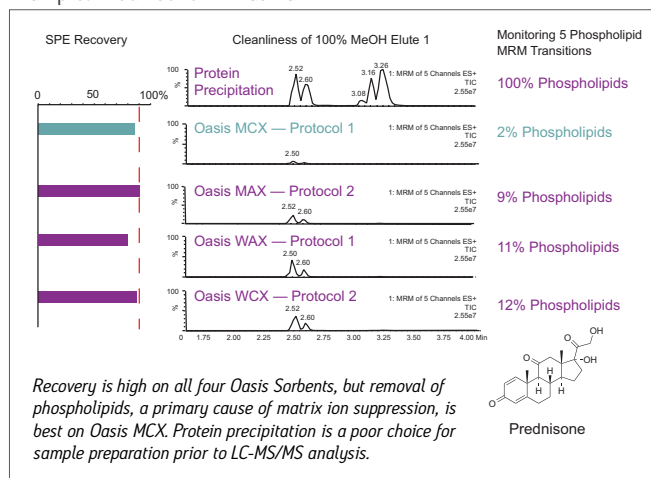
- Characterize your analyte (neutral, acid, or base, pK_a)
- Select one of the four Oasis Sorbents
- Apply the indicated protocol (1 or 2)
- Determine SPE recoveries by LC analysis

Note that neutral analytes can be isolated from any of the four sorbents in the Elute 1 step of either protocol. Choose the particular ion-exchange sorbent that is best at removing specific matrix interferences. An example of this is shown below.



Choosing Optimum Sorbent and Protocol for Neutral Compounds

Example: Prednisone in Plasma



Did you know...

How to Select the Right Oasis Mixed-Mode Sorbent

Watch this detailed video to learn how to use the Oasis 2x4 Method to select the most effective SPE sorbent:

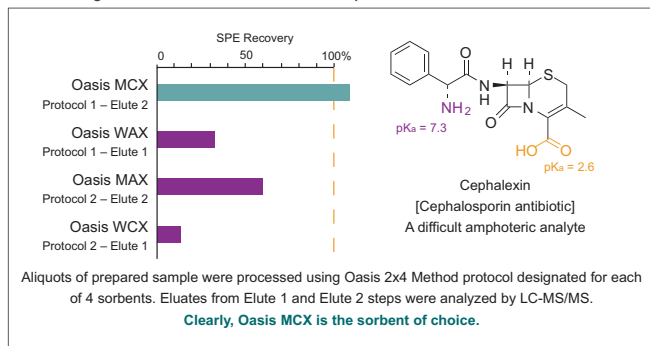
www.waters.com/oasis



Oasis Sorbent Selection Tools for Convenient Method Development

Oasis sorbent selection plate and cartridge kits enable rapid development of SPE methods for LC-MS analysis. Having all four Oasis Ion-exchange Sorbents (MCX, MAX, WAX, and WCX) in a single plate or a cartridge kit is convenient for scouting the best ways to accomplish efficient isolation of unknown analytes, zwitterionic compounds, or mixtures of analytes with different retention/elution properties.

Oasis Sorbent Selection 96-well Plate: Evaluating Oasis 2 x 4 Method for Cephalexin



Oasis 2x4 Method Proof of Concept for Cartridges and Standard 96-well Plates

To demonstrate the logic, simplicity, and effectiveness of the Oasis 2x4 Method, five rat plasma samples were prepared, each containing one of these characterized test analytes:

- Imipramine, a base (pKa of conjugate acid = 9.4)
- Ibuprofen, an acid (pKa = 5.2)
- Decanesulfonic acid, a strong acid (pKa < 0.5)
- Valetamate, a quaternary amine [strong base] (pKa > 12)
- Prednisone, a neutral compound

Each plasma sample was diluted (1:1, v/v) and acidified with phosphoric acid (4% in water). Respective aliquots were then processed using the protocol and the Oasis ion-mixed-mode sorbent

designated by the Oasis 2x4 Method for the corresponding sample type. LC-MS/MS analysis was used to determine SPE recoveries.

The neutral analyte was processed on all four sorbents, as shown on the [previous page](#). Of the four method options, Oasis MCX with Protocol 1 proved superior at removing nearly all the phospholipids, eliminating this major source of matrix effects, a known cause of ion suppression, loss of sensitivity, and inaccurate quantitation in LC-MS analysis.

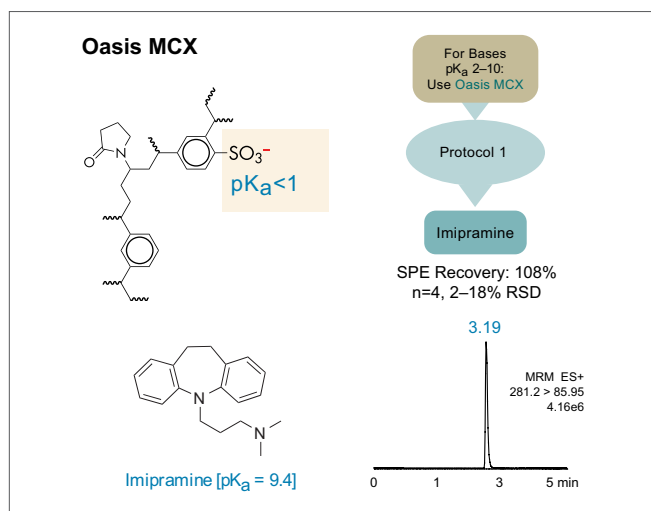
Essentially, quantitative recovery and excellent cleanup efficiency were achieved for each of the ionic or ionizable test analytes when the recommended Oasis 2x4 Method sorbent/protocol combination was used. These results are shown in the four figures below.



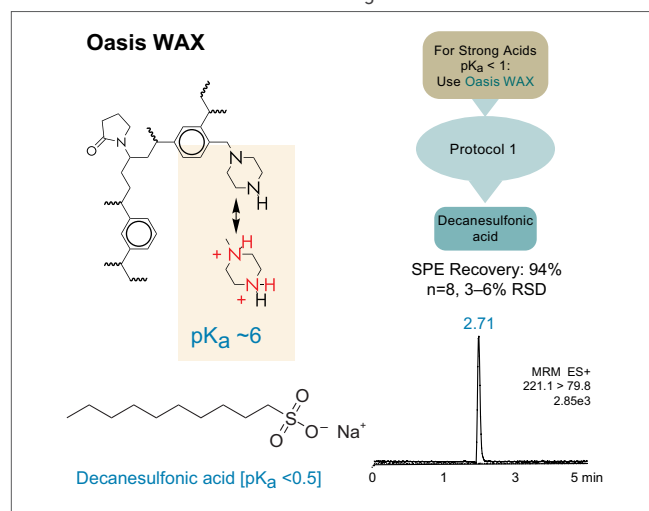
Oasis Method Development Kits

Description	Format	Particle Size	Part No.
Oasis Sorbent Selection Plate, 3 rows each: MCX, MAX, WCX, and WAX	30 mg/96-well	30 μm	186003249
Oasis μElution Sorbent Selection Plate, 3 rows each: MCX, MAX, WCX, and WAX	2 mg/96-well	30 μm	186004475
Oasis Sorbent Selection Cartridge Kit, 10 each: MCX, MAX, WCX, and WAX	1 cc/30 mg	30 μm	186003463
Oasis Sorbent Selection Flangeless Cartridge Kit, 10 each: MCX, MAX, WCX, and WAX	1 cc/10 mg	30 μm	186006344
Oasis Sorbent Selection Flangeless Cartridge Kit, 10 each: MCX, MAX, WCX, and WAX	1 cc/30 mg	30 μm	186006345

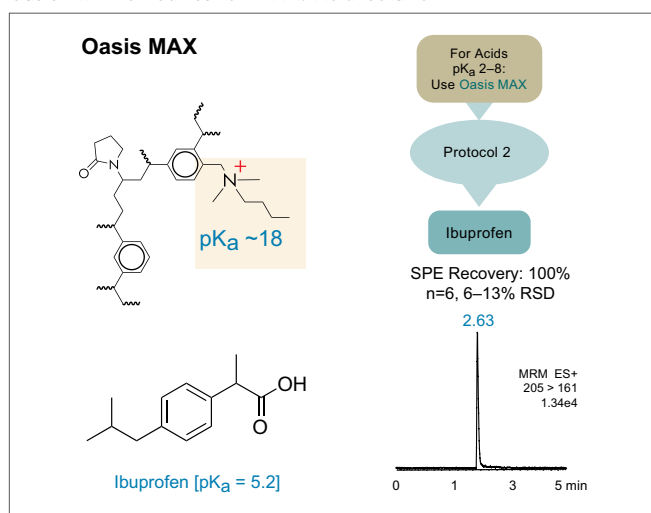
Oasis 2x4 Method Test on MCX: Base Isolation



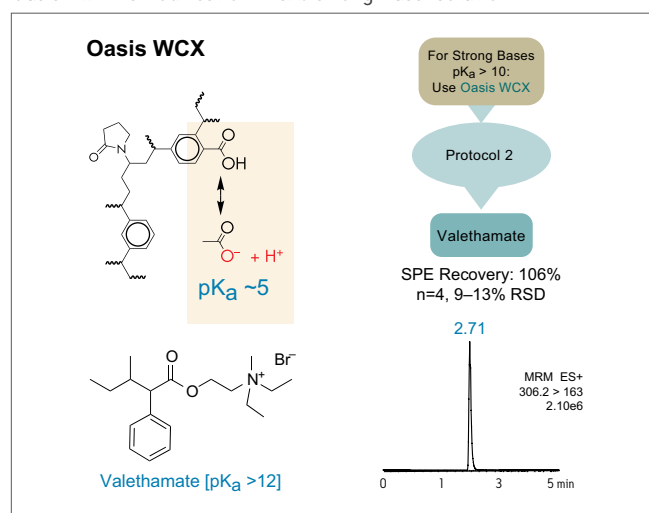
Oasis 2x4 Method Test on WAX: Strong Acid Isolation



Oasis 2x4 Method Test on MAX: Acid Isolation



Oasis 2x4 Method Test on WCX: Strong Base Isolation



Oasis μ Elution 96-well Plates

Waters Innovative SPE Technology

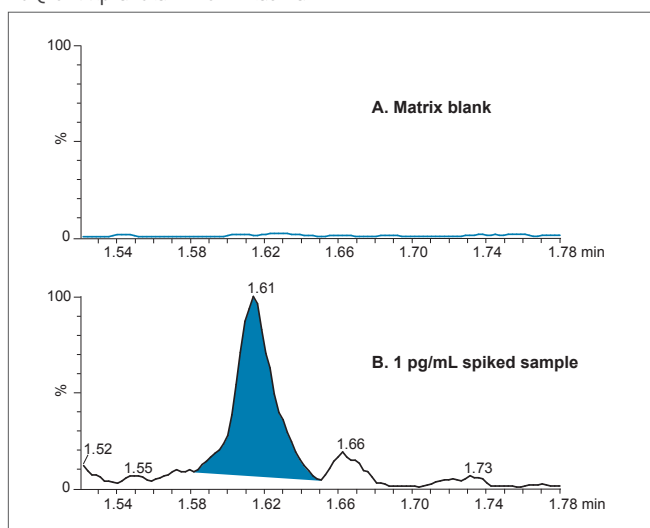
- Patented μ Elution plate design.
- Ideal for SPE cleanup and analyte enrichment of sample volumes ranging from 10 μ L–375 μ L.
- No evaporation and reconstitution necessary due to elution volumes as low as 25 μ L.
- Up to a 15x increase in concentration.
- Compatible with most liquid-handling robotic systems for automated, reliable high throughput SPE (HT-SPE).
- Ideally suited for small molecules as well as therapeutic peptides.
- Minimizes adsorption and sample loss.



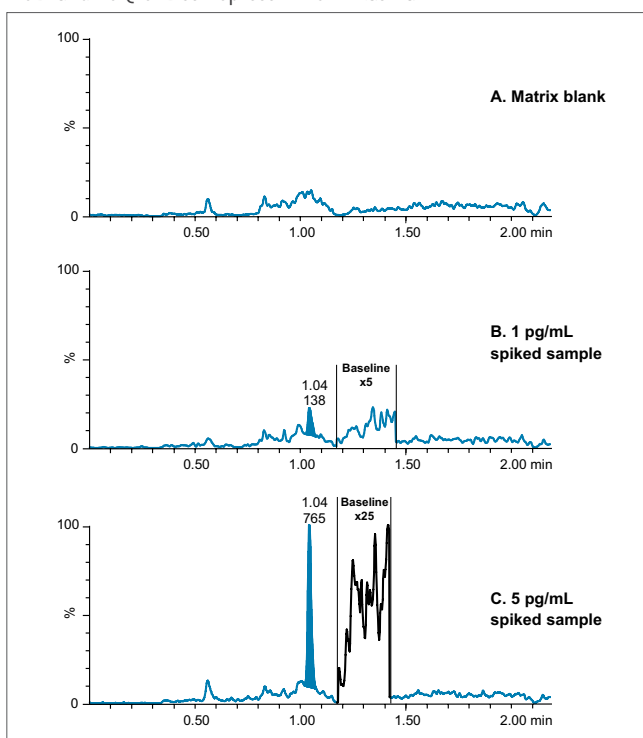
Sensitivity

The Oasis Mixed-mode Sorbents, which are all built upon the unique water-wettable Oasis HLB copolymer, provide dual modes of retention, enabling greater cleanup selectivity and sensitivity for both acidic and/or basic compounds—even if the sorbent in the wells runs dry. An example of this outstanding sensitivity can be seen with the Oasis μ Elution Plate. This product employs a patented design to concentrate a sample up to 15x without requiring evaporation or reconstitution.

LOQ of Alprazolam from Plasma



LOD and LOQ of Desmopressin from Plasma



Reduced Matrix Effects

The presence of matrix interferences in a sample limits the maximum sensitivity that can be achieved. This constraint can be overcome by cleaning the sample with SPE products prior to further analysis.

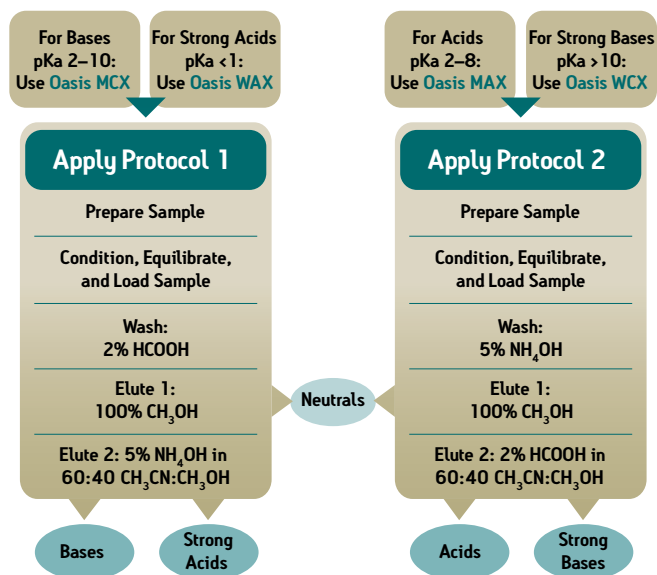
Analyte	% RSD of Matrix Factors
Amitriptyline	6.03
Nortriptyline	5.53
Imipramine	8.36
Desipramine	7.15
Doxepin	5.96

Following extraction with an Oasis Mixed-mode Sorbent, the matrix effects were evaluated for a panel of 5 antidepressant drugs in multiple lots of urine. The RSD of the matrix factors was determined to be between 5.5 and 8.4%, which is well within the 15% limit required by regulatory agencies.

Oasis μ Elution 96-well Plates

Description	Particle Size	Qty.	Part No.
Oasis HLB	30 μ m	1/pk	186001828BA
Oasis MCX	30 μ m	1/pk	186001830BA
Oasis MAX	30 μ m	1/pk	186001829
Oasis WCX	30 μ m	1/pk	186002499
Oasis WAX	30 μ m	1/pk	186002500

Oasis 2x4 Method Optimized for μ Elution Plate



Oasis 2x4 Method Proof of Concept for μ Elution Plates

Recovery Study

To demonstrate the logic, simplicity, and effectiveness of the Oasis 2x4 Method, five samples of rat plasma were prepared, each spiked with one of the previously characterized test analytes shown below:

- Imipramine: pK_a = 9.4 (Base)
- Ibuprofen: pK_a = 5.2 (Acid)
- Valethamate: pK_a >12 (Quaternary Amine)
- Nonafluoropentanoic Acid: pK_a <0.5 (Strong Acid)
- Prednisone: Neutral

Each plasma sample was diluted (1:1, v:v) and acidified with 4% phosphoric acid in water. Respective aliquots were then processed using the protocol and the Oasis Ion-mixed-mode Sorbent designated by the Oasis 2x4 Method for the corresponding sample type. LC-MS/MS analysis was used to determine SPE recoveries. The neutral analyte was processed on all four sorbents used.



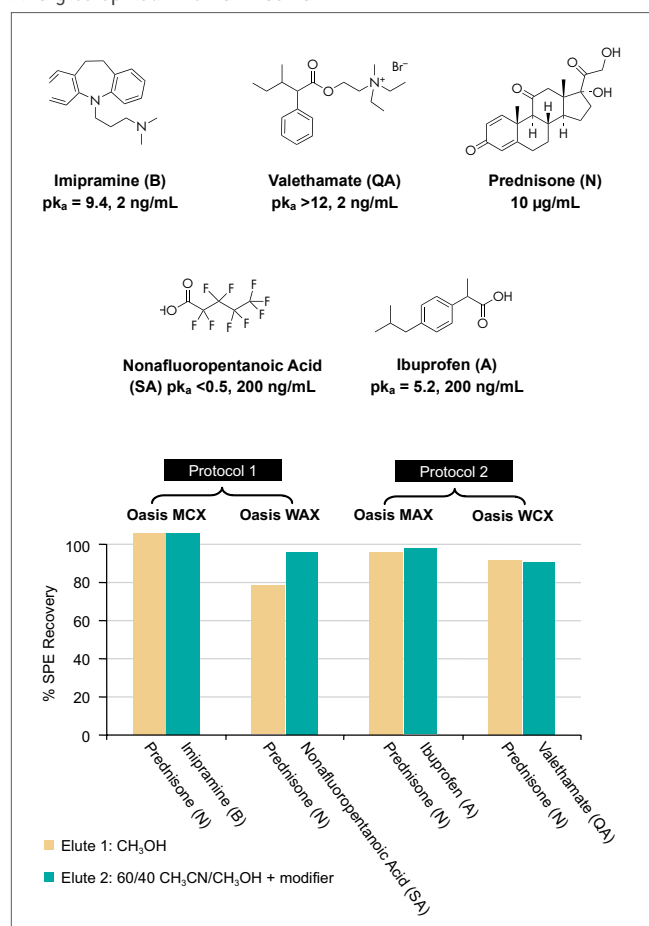
The elution solvent used for the Oasis 2x4 Method is optimized to accommodate the elutropic requirement of the small elution volume. Methanol is good as a generic elution solvent, but is often not strong enough for 25 μ L elution volumes. The elution solvent recommended to be used with the μ Elution plate must possess a high enough elutropic strength to fully elute analytes in small volumes, and be appropriate for a diverse set of analytes.

The recommended elution solvent for the Oasis 2x4 Method optimized for the μ Elution plate format is 60% CH₃CN:40% CH₃OH with a modifier. This was chosen as a starting point as it meets all of the above criteria.

Follow the simple steps outlined in this flow chart to achieve high recoveries and the cleanest extracts:

- Characterize your analyte (neutral, acid or base, pK_a)
- Select one of the four Oasis Sorbents
- Apply the indicated Protocol (1 or 2)
- Determine SPE recoveries by LC analysis

Analytes Spiked into Rat Plasma

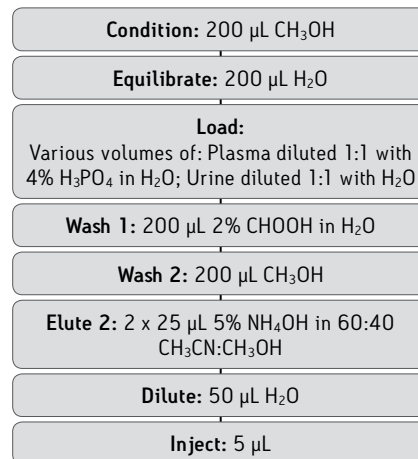


μElution Plate Loading Capacity

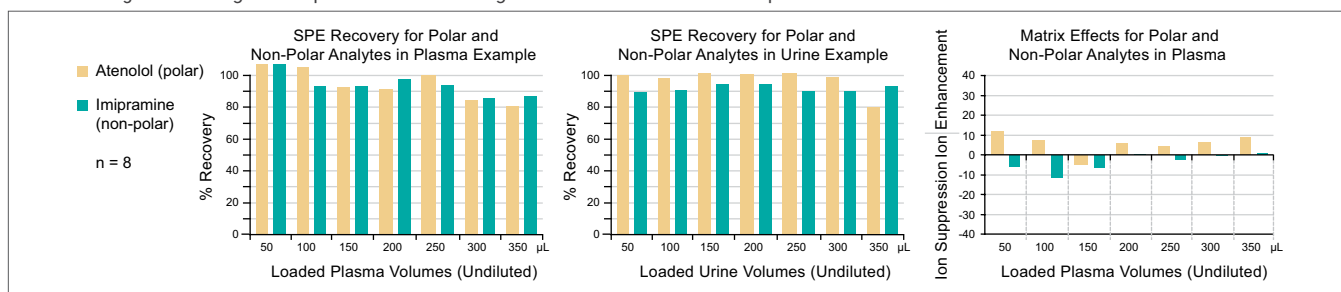
SPE device capacity is defined as the total mass of analytes and endogenous sample components retained by the sorbent bed under loading conditions. Breakthrough will occur when the capacity of the sorbent bed is exceeded. The physicochemical properties of Oasis Sorbents are designed to provide exceptionally high loading capacity, even though each well in a Waters Oasis μElution Plate contains only 2 mg of Oasis Sorbent.

To determine the Oasis μElution plate capacity, increasing volumes of undiluted plasma and urine samples (from 50 μL to 350 μL in 50 μL increments) were spiked with 200 ng/mL imipramine (non-polar base) and 200 ng/mL atenolol (polar base). The plasma aliquots were diluted 1:1 with 4% aqueous H₃PO₄ and the urine aliquots were diluted 1:1 with H₂O and then loaded onto the Oasis MAX μElution Plate. SPE recovery was calculated and plotted for each loading level.

SPE Protocol for Oasis MCX μElution 96-well Plate



SPE Recovery for 200 ng/mL Imipramine and 200 ng/mL Atenolol on Oasis MCX μElution Plate

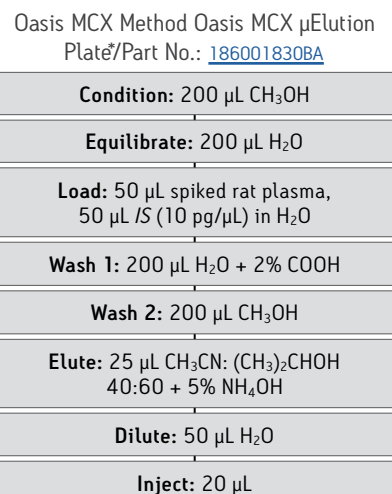
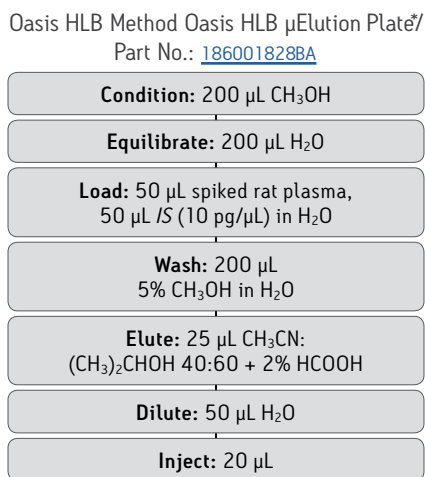
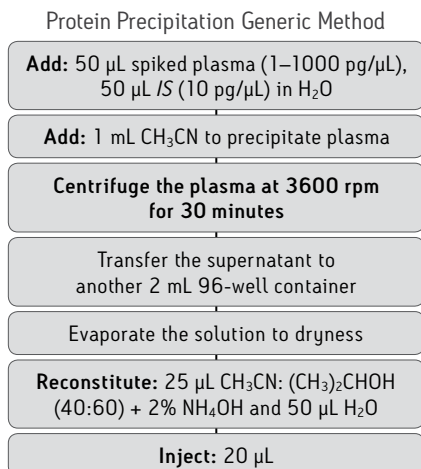


Superior Results, Less Time and Effort than Protein Precipitation

The Oasis μElution Plate optimizes the configuration of the highly efficient Oasis Sorbents (HLB, MCX, MAX, WCX, and WAX), enabling elution volumes as low as 25 μL and providing fast cleanup with improved performance over protein precipitation. Time-consuming evaporation and reconstitution steps are eliminated, compressing preparation cycle time and increasing throughput capabilities.

The protein precipitation generic method includes both a centrifugation and an evaporation step, which produces the cleanest sample extract possible for protein precipitation. The final sample volume (75 μL) is the same for all three generic methods. The Oasis generic methods produce cleaner extracts than protein precipitation, demonstrated by the improved sensitivity with the Oasis HLB (4x) and the Oasis MCX Method (9–25x). The Oasis Method enables improved sensitivity by eliminating matrix effect and reducing ion suppression. Oasis μElution Plates achieve superior results compared to protein precipitation in less time.

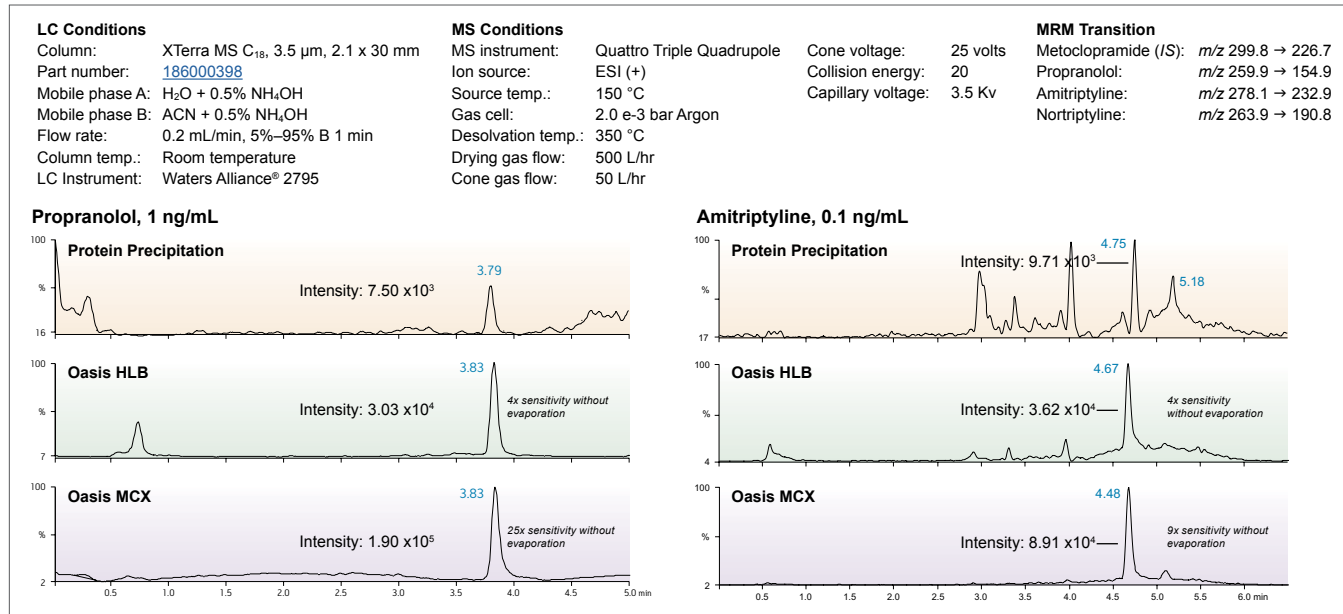
Extraction Protocols



Increase in Selectivity (More Selective Methods)

* Tomtec Quadra96™ used.

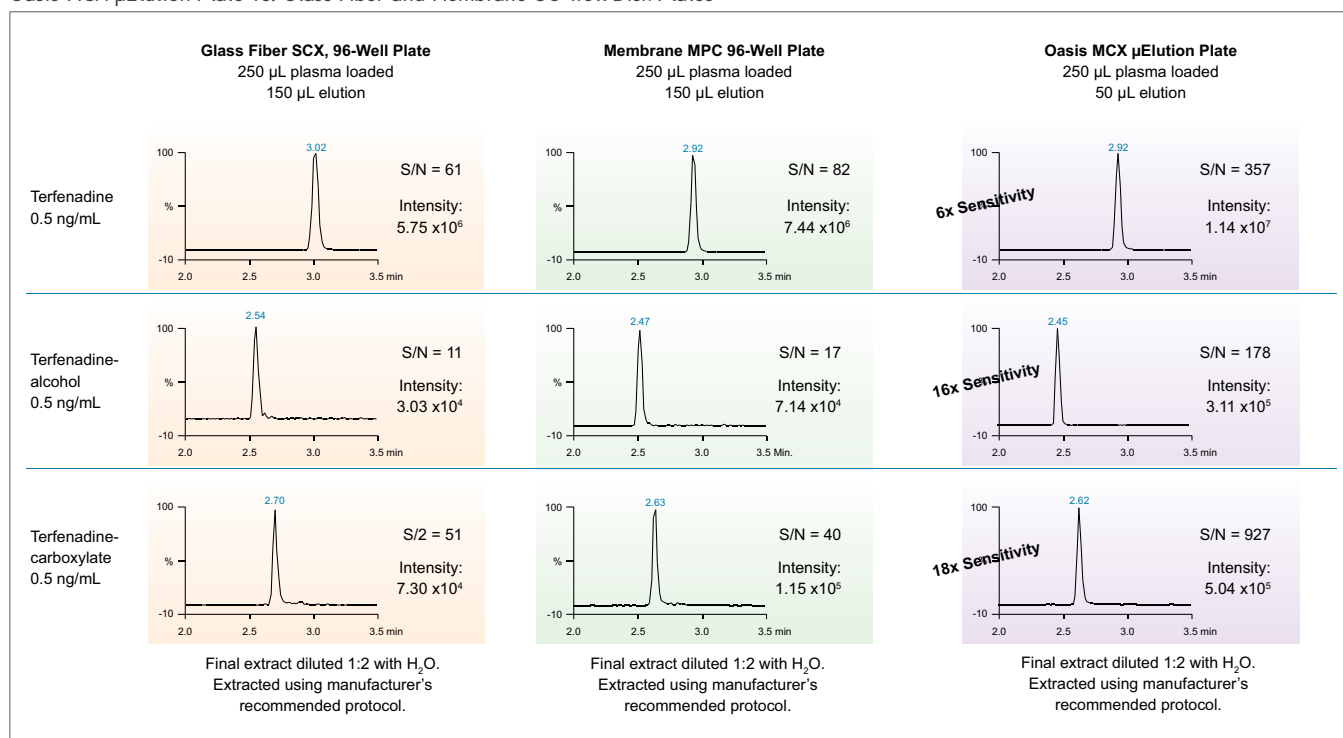
Oasis HLB and MCX μ Elution Plate vs. Protein Precipitation



Greater Sensitivity and Precision than Glass Fiber and Membrane 96-well Disk Plates

The Oasis μ Elution Plates show superior performance when compared to low elution disk plate products used according to recommended protocols. A generic Oasis MCX Method for terfenadine with 50 μ L elution, dilution, and direct injection shows better sensitivity than the membrane and glass fiber plates, which require a 150 μ L elution volume for complete analyte recovery. The Oasis μ Elution Plate enables sensitivity gains and delivers high performance without the time consuming evaporation step.

Oasis MCX μ Elution Plate vs. Glass Fiber and Membrane 96-well Disk Plates



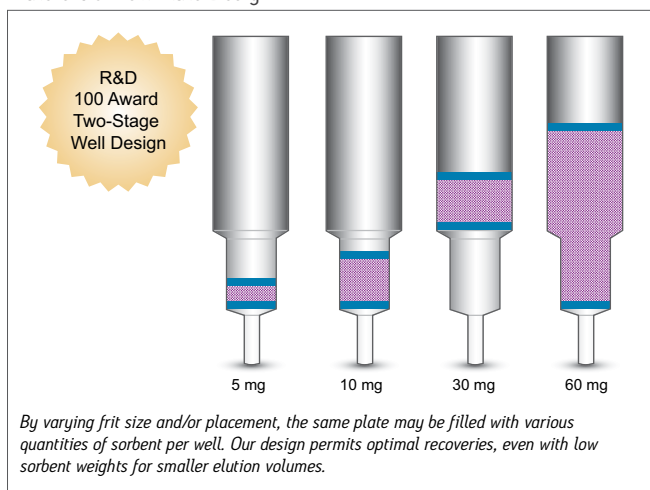
Oasis 96-well High Throughput Extraction Plates

Waters award-winning plate design, with five chemistry and four sorbent-mass options, provides flexible high throughput SPE in a single device. The Oasis 96-well Plates are designed to be used on many manifold configurations and most robotic liquid handling systems. Oasis Sorbents' unique balance of hydrophobicity and water-wettability means you will never have to worry about poor results if individual wells of the 96-well plate dry out. As always, you can expect Oasis SPE Products to perform reliably, delivering high and reproducible recoveries for a wide range of analytes, including polar and basic compounds, with RSDs less than 5% (n=96).

- Innovative, award-winning two-stage well design.
- High throughput and high recovery.
- Available with 5 mg, 10 mg, 30 mg, and 60 mg of sorbent per well.
- Compatible with most liquid-handling robotic systems for automated, reliable high throughput SPE (HT-SPE).



Waters 96-well Plate Design



Oasis 96-well Plates					
	Particle Size	5 mg/ 96-well	10 mg/ 96-well	30 mg/ 96-well	60 mg/ 96-well
Description		1/pk	1/pk	1/pk	1/pk
Oasis HLB	30 μ m	186000309	186000128	WAT058951	—
Oasis HLB	60 μ m	—	—	—	186000679
Oasis MCX	30 μ m	—	186000259	186000248	—
Oasis MCX	60 μ m	—	—	186000250	186000678
Oasis MAX	30 μ m	—	186000375	186000373	186001256
Oasis MAX	60 μ m	—	—	—	186001205
Oasis WCX	30 μ m	—	186002501	186002503	—
Oasis WAX	30 μ m	—	186002502	186002504	186003915



Ordering online has never been easier or more secure!

Go to www.waters.com/order and you can:

- ✓ Check out our latest discounts for online shopping.
- ✓ Find out pricing and product availability quickly and easily.
- ✓ Set up wish lists for important, upcoming projects.
- ✓ eMail your cart or wish list to other project or purchasing colleagues.



Oasis On-Line Columns and Cartridges

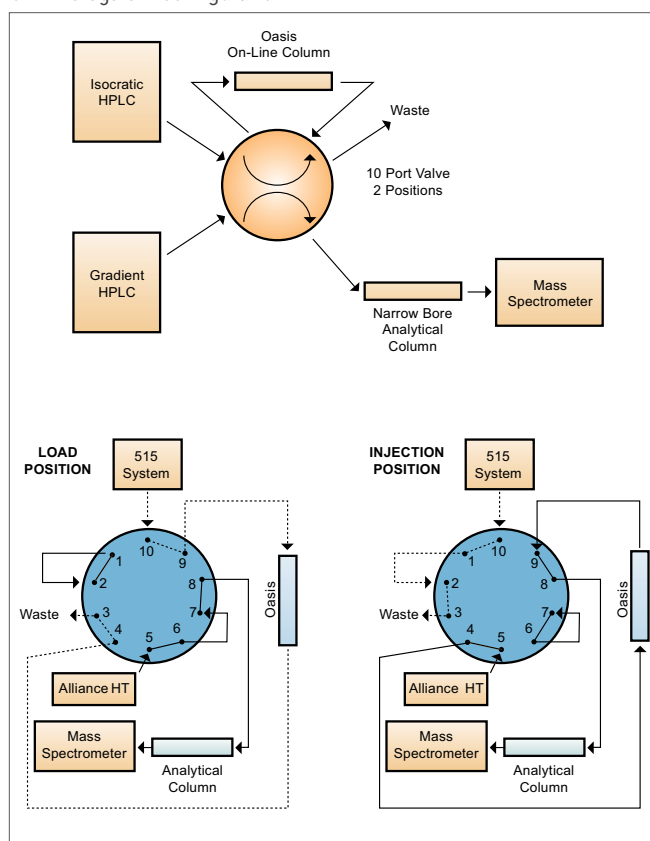
There are three HPLC Oasis On-line Column configurations designed to fit all your on-line analysis needs.

1. The Oasis Cartridge Column fits into a Sentry™ Holder that features a finger-tight fitting for fast, convenient replacement.
2. The Oasis Direct-connect Column can be screwed directly into a switching valve or connected to fittings like those for a conventional HPLC column.
3. The Oasis Column features traditional HPLC column fittings and hardware.

All of these formats are available with the five Oasis patented sorbents (HLB, MCX, MAX, WCX, and WAX) in a wide choice of particle sizes and dimensions. The Oasis On-line Columns make it possible to analyze a specific analyte in a sample matrix when combined with appropriate Waters narrow-bore analytical columns (such as XSelect®, XBridge, SunFire, Atlantis®, XTerra, or Symmetry® Columns).



On-Line System Configuration



On-Line SPE Columns and Cartridge Columns

Description	Format	Particle Size	Qty.	Part No.
Oasis HLB Column	2.1 x 20 mm	5 µm	1/pk	186002034
Oasis HLB Column	3.0 x 20 mm	5 µm	1/pk	186002037
Oasis HLB Column	3.9 x 20 mm	5 µm	1/pk	186002040
Oasis HLB Cartridge Column	3.9 x 20 mm	5 µm	1/pk	186001413
Oasis HLB Column	4.6 x 20 mm	5 µm	1/pk	186002043
Oasis HLB Column	2.1 x 20 mm	15 µm	1/pk	186002035
Oasis HLB Column	3.0 x 20 mm	15 µm	1/pk	186002038
Oasis HLB Column	3.9 x 20 mm	15 µm	1/pk	186002041
Oasis HLB Cartridge Column	3.9 x 20 mm	15 µm	1/pk	186001414
Oasis HLB Column	4.6 x 20 mm	15 µm	1/pk	186002044
Oasis HLB Column	2.1 x 20 mm	25 µm	1/pk	186002036
Oasis HLB Cartridge Column	2.1 x 20 mm	25 µm	1/pk	186000706
Oasis HLB Column	3.0 x 20 mm	25 µm	1/pk	186002039
Oasis HLB Column	3.9 x 20 mm	25 µm	1/pk	186002042
Oasis HLB Column	4.6 x 20 mm	25 µm	1/pk	186002045
Oasis HLB Direct Connect Column	2.0 x 15 mm	25 µm	1/pk	186001792
Oasis MCX Column	2.1 x 20 mm	30 µm	1/pk	186002046
Oasis MCX Cartridge Column	2.1 x 20 mm	30 µm	1/pk	186002051
Oasis MCX Column	3.0 x 20 mm	30 µm	1/pk	186002047
Oasis MCX Column	3.9 x 20 mm	30 µm	1/pk	186002048
Oasis MCX Column	4.6 x 20 mm	30 µm	1/pk	186002049
Oasis MAX Column	2.1 x 20 mm	30 µm	1/pk	186002052
Oasis MAX Cartridge Column	2.1 x 20 mm	30 µm	1/pk	186002057
Oasis MAX Column	3.0 x 20 mm	30 µm	1/pk	186002053
Oasis MAX Column	3.9 x 20 mm	30 µm	1/pk	186002054
Oasis MAX Column	4.6 x 20 mm	30 µm	1/pk	186002055
Oasis WCX Column	2.1 x 20 mm	30 µm	1/pk	186002505
Oasis WCX Column	3.9 x 20 mm	30 µm	1/pk	186002507
Oasis WAX Column	2.1 x 20 mm	30 µm	1/pk	186002508
Oasis WAX Column	3.9 x 20 mm	30 µm	1/pk	186002509

Oasis On-Line Cartridges for Symbiosis/Prospekt-2 Systems

These single-use cartridges are designed for rugged, reproducible, and ultra-fast on-line SPE on Spark Holland's Symbiosis/Prospekt-2 Systems. Each cartridge contains the appropriate patented Oasis Sorbent that has been optimized to achieve higher selectivity and sensitivity. There is 2.5 mg of sorbent in each 1.0 x 10 mm cartridge and 10.4 mg of sorbent in each 2.0 x 10 mm cartridge. Each 800-series tray contains 96 cartridges and can be directly loaded into the Automatic Cartridge Exchange (ACE™) or the ACE Feeder units of the Symbiosis/Prospekt-2 Systems without the stainless steel tray holder/adaptor. For additional information on the Symbiosis and Prospekt-2 Systems, go to

www.spark.nl



Oasis Symbiosis/Prospekt-2 Cartridges				
Description	Format	Particle Size	Qty.	Part No.
Oasis HLB Symbiosis/Prospekt-2 Cartridge	1 x 10 mm	30 µm	96/box	186005781
Oasis HLB Symbiosis/Prospekt-2 Cartridge	1 x 20 mm	30 µm	96/box	186005786
Oasis MCX Symbiosis/Prospekt-2 Cartridge	1 x 10 mm	30 µm	96/box	186005782
Oasis MCX Symbiosis/Prospekt-2 Cartridge	1 x 20 mm	30 µm	96/box	186004653
Oasis MAX Symbiosis/Prospekt-2 Cartridge	1 x 10 mm	30 µm	96/box	186005783
Oasis MAX Symbiosis/Prospekt-2 Cartridge	1 x 20 mm	30 µm	96/box	186004654
Oasis WCX Symbiosis/Prospekt-2 Cartridge	1 x 10 mm	30 µm	96/box	186005784
Oasis WCX Symbiosis/Prospekt-2 Cartridge	1 x 20 mm	30 µm	96/box	186004655
Oasis WAX Symbiosis/Prospekt-2 Cartridge	1 x 10 mm	30 µm	96/box	186005785
Oasis WAX Symbiosis/Prospekt-2 Cartridge	1 x 20 mm	30 µm	96/box	186004656

Online Solid Phase Extraction (SPE) Cartridges

Waters Online Solid-Phase Extraction (SPE) Cartridges are designed or use on the ACQUITY UPLC Online SPE Manager (OSM).

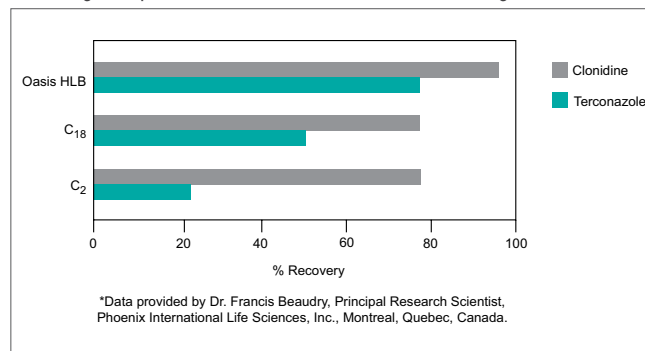
Oasis WCX Sorbent is a patented polymeric sorbent that uses reversed-phase and weak cation exchange retention mechanisms for highly selective sample preparation of strongly basic compounds.

Description	Format	Particle Size	Qty.	Part No.
Oasis WCX OSM Cartridge	1 x 10 mm	30 µm	96/pk	186005671

The XBridge C₁₈ and C₈ Sorbents use Waters proprietary Ethylene Bridged Hybrid (BEH) Technology to produce a sorbent with high mechanical strength, and excellent stability for reverse phase separations. These sorbents can provide separations with superior peak shape and high efficiency.

Description	Format	Particle Size	Qty.	Part No.
XBridge C ₁₈ OSM Cartridge	1 x 10 mm	10 µm	96/pk	186005672
XBridge C ₈ OSM Cartridge	1 x 10 mm	10 µm	96/pk	186005673

Recovery Comparison: Oasis HLB vs. Bonded-Silica Symbiosis Cartridge



SPE Columns for Waters UPLC with On-Line SPE Technology

UPLC with On-line SPE Technology combines automated sample handling, proprietary chromatographic media, and ultra-sensitive optical and mass spectrometry detection into an on-line SPE-LC-MS/MS solution.

When paired with one of the following three UPLC pressure-enabled on-line SPE column chemistries, you have the ability to extract a wide range of analytes:

- Oasis HLB Direct Connect HP Column, 2.1 x 30 mm, 20 µm
- XBridge C₁₈ Direct Connect HP Column, 2.1 x 30 mm, 10 µm
- XBridge C₈ Direct Connect HP Column, 2.1 x 30 mm, 10 µm

This proven system and column chemistries dramatically streamlines the analysis of drinking water samples by providing analyte extraction, concentration, separation, and detection in one turnkey solution.

To learn more, visit www.waters.com/onlineSPE



SPE Columns for Waters UPLC with On-Line SPE Technology				
Description	Format	Particle Size	Qty.	Part No.
Oasis HLB Direct Connect HP Column	2.1 x 30 mm	20 µm	1/pk	186005231
XBridge C ₁₈ Direct Connect HP Column	2.1 x 30 mm	10 µm	1/pk	186005232
XBridge C ₈ Direct Connect HP Column	2.1 x 30 mm	10 µm	1/pk	186005233

Oasis Bulk Sorbents

Oasis products are used by separation scientists across the globe to solve the most difficult and highly selective challenges in sample preparation and purification. Researchers rely on the superior technical performance of Oasis products to achieve unmatched purity, consistency, and quality in their results.

- Unsurpassed selectivity
- Consistent retention and capacity, yielding the highest recovery
- Wide selection of sorbents
- Broad array of chemistries

SPE Columns for Waters UPLC with On-Line SPE Technology			
Description	Particle Size	Qty.	Part No.
Oasis HLB	30 µm/100 gm	—	186007549
Oasis HLB	30 µm/250 gm	—	186007550
Oasis MAX	30 µm/100 gm	—	186007551
Oasis MAX	30 µm/250 gm	—	186007552
Oasis MCX	30 µm/100 gm	—	186007553
Oasis MCX	30 µm/250 gm	—	186007554
Oasis HLB Glass Cartridge	60 µm	30/box	186000683

Endocrine Disruptors

Recovery of Phthalates and Nonylphenol from River Water, GC-MS, 200 ng/L Spike Level, n=4			
Results	% Recovery	% RSD	
1. Dimethylphthalate	130	15	
2. Diethylphthalate	86	12	
3. n-nonylphenol	90	11	
4. Dibutylphthalate	110	11	
5. Benzylbutylphthalate	110	8	
6. Bis(ethylhexyl)phthalate	60	8	
7. ISTD. o-terphenyl (internal standard)	—	—	

Oasis Glass Cartridges for PPT Detection Levels

Waters Oasis glass cartridges are available in a 5 cc (200 mg) configuration with Teflon® Frits for trace analysis at parts per trillion (PPT) levels. Each lot is tested for the presence of bisphenol A and other phenols and phthalates, assuring that endocrine disruptors in water samples can be analyzed to PPT levels.



Recovery of Estrogens from River Water, LC-MS, 5 ng/L Spike Level, n=4			
Results	Ions Monitored (m/z)	% Recovery	% RSD
1. Bisphenol A	227	113	11
2. 17β-estradiol	271	93	15
3. 17α-ethynylestradiol	295	96	12
4. Estrone	269	87	5
5. Diethylstilbestrol	267	75	5

ENVIRONMENTAL AND FOOD SOLUTION KITS

ACQUITY UPLC PFC Column Kit

Optimized for trace level detection of Perfluorinated Compounds (PFCs) with the ACQUITY UPLC System, this kit contains the ACQUITY UPLC BEH C₁₈, 1.7 μm, 2.1 x 50 mm Column, the ACQUITY UPLC PFC Isolator Column and PFC reference standards.



Description	Part No.
ACQUITY PFC Column Kit	176001692

ACQUITY UPLC Bisphenol A Column and Method Kits

The ACQUITY UPLC Bisphenol A Column and Method Kits are fully compliant with ASTM Method D7574-09. Waters ACQUITY UPLC Solution provides optimum resolution and sensitivity for the analysis of Bisphenol A in water. The Column Kit includes the ACQUITY UPLC BEH C₁₈ Column and ACQUITY UPLC Isolator Column. The Method Kit also includes Oasis HLB SPE Cartridges and LCMS Certified Vials.



Description	Part No.
ACQUITY Bisphenol A Column Kit	176001955
ACQUITY Bisphenol A Method Kit	186004932

ACQUITY UPLC PFC Analysis Kit

The ACQUITY UPLC PFC Analysis Kit includes Oasis SPE Cartridges, PFC calibration and reference standards, certified vials, ACQUITY UPLC Columns, and the necessary instrument components to optimize your instrument for trace level detection of PFCs.



Description	Part No.
ACQUITY PFC Analysis Kit	176001744

EPA Method 1694 Analysis Kit

Waters EPA Method 1694 Analysis Kit includes the XTerra MS C₁₈, Atlantis HILIC Columns, and Oasis HLB Cartridges; all of which are specified in the EPA Method.



Description	Part No.
EPA Method 1694 Analysis Kit	176001634
Sep-Pak Vac, 500 mg, PS2 (30/box)	WAT200601
Sep-Pak QMA Plus Carbonate, 46 mg (50/box)	186004540

SOFT DRINK ANALYSIS

Choose Waters

Soft Drink Analysis 4 Component Standard

The Soft Drink Analysis 4 Component Standard is intended for HPLC-UV analysis of soft drink formulations for sweeteners and preservatives using the NovaPak® C₁₈ Column. This standard mix contains four vials of aspartame powder (100 mg) and a 1 L solution of denatured ethanol containing caffeine (100 mg/L), benzoate (200 mg/L), and sorbate (100 mg/L).

Description	Part No.
Soft Drink Analysis 4 Component Standard	WAT036889
Soft Drink Analysis Mobile Phase	WAT036888
NovaPak C ₁₈ Column	WAT086344

→ Learn more at asr.waters.com

Soft Drink Analysis 5 Component Standard

The Soft Drink Analysis 5 Component Standard is intended for HPLC-UV analysis of soft drink formulations for sweeteners and preservatives using the SunFire C₁₈ Column. This mix contains four vials of aspartame powder (100 mg) and a 1 L solution of denatured ethanol containing caffeine (100 mg/L), benzoate (262.4 mg/L), sorbate (134 mg/L), and acesulfame K (150 mg/L).

Description	Part No.
Soft Drink Analysis 5 Component Standard	186003856
Soft Drink Analysis SF36 Mobile Phase	186003858
SunFire® C ₁₈ Column	186003417

→ Learn more at asr.waters.com

Waters

THE SCIENCE OF WHAT'S POSSIBLE.®

SEP-PAK SOLID-PHASE EXTRACTION (SPE) PRODUCTS

The Most Referenced and Widely Used Sample Preparation Technology

Sep-Pak bonded silica devices are recognized throughout the world and remain the most referenced SPE product for sample preparation. A diverse selection of formats and sorbents make Sep-Pak SPE Products ideally suited for all types of samples for GC, HPLC, and UPLC analysis methods.

Formats:

- Cartridges
- 96-well plates
- μ Elution plates

Wide range of chemistries:

■ Reversed phase (silica based)

tC_2 -bonded phase with low hydrophobic characteristics

C_8 -bonded phase with moderate hydrophobicity

C_{18} -monofunctional bonded phase, a Waters original

tC_{18} -tri-functional bonded phase with increased hydrolytic stability

■ Reversed or normal phase (less polar alternatives to silica)

Aminopropyl (NH₂)-basic polar bonded phase

Cyanopropyl (CN)-polar bonded phase

Diol-neutral polar bonded phase

PSA-primary-secondary amine

■ Normal phase

Silica-polar surface used to adsorb analytes from non-polar solvents

Alumina (A, B, & N)-a highly active grade of alumina that is available in acidic, basic, and neutral surface chemistries

Florisil™-polar, highly active, weakly basic sorbent for adsorption of low to moderate polarity species from nonaqueous solutions



■ Ion exchange (silica based)

Accell Plus QMA-hydrophilic strong anion exchanger with large pore size

Accell Plus CM-hydrophilic weak cation exchanger with large pore size

■ Specialty

PoraPak RDX-for analysis of explosives in ground and surface water, EPA-8330

Sep-Pak™ Dry-anhydrous Na₂SO₄ for removal of residual water from non-aqueous extracts

DNPH Silica-for air analysis of aldehydes and ketones, EPA-TO-11A, ASTM D-5791

XPOsure™-for indoor air monitoring of aldehydes and ketones

AC2-activated carbon used to concentrate pesticides and herbicides

PS2-styrene-divinyl benzene polymer used to concentrate pesticides and herbicides

Carbon Black/Aminopropyl-for pesticides from food

Carbon Black/PSA-for concentrating pesticides from food

Sep-Pak 96-well Plates

Description	Part No.
Sep-Pak tC_{18} 25 mg Plate	186002319
Sep-Pak tC_{18} 40 mg Plate	186002320
Sep-Pak tC_{18} 100 mg Plate	186002321
Sep-Pak Accell™ Plus QMA 100 mg Plate	186001917
Sep-Pak C_{18} 40 mg Plate	186003966

Sep-Pak 96-well μ Elution Plates

Description	Part No.
Sep-Pak tC_{18} μ Elution Plate	186002318

Sep-Pak Sorbent Selection Guide

Reversed Phase			
	Description	Applications	Properties
Sep-Pak C ₁₈ Si(CH ₃) ₂ C ₁₈ H ₃₇	Hydrophobic, silica-based bonded phase used to adsorb analytes from aqueous solutions. Monofunctional bonding provides alternate selectivity versus tC ₁₈ .	<ul style="list-style-type: none"> Lipid fractionation; ganglioside isolation Organic acids in fruit juice, wine JPMHLW and CDFA official methods for pesticides in food Natural products AOAC methods for food colors, sugars 	Particle size: 55–105 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 12% pH range: 2–8
Sep-Pak tC ₁₈ SiC ₁₈ H ₃₇	Strongly hydrophobic, silica-based bonded phase used to adsorb analytes from aqueous solutions. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in water JPMHLW official methods for odorants in water 	Particle size: 37–55 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 17% pH range: 2–8
Sep-Pak C ₈ Si(CH ₃) ₂ C ₈ H ₁₇	Moderately hydrophobic, silica-based bonded phase used in methods when less retention than that of HLB or C ₁₈ is required.	<ul style="list-style-type: none"> Drugs and their metabolites in biofluids Peptides in serum and plasma 	Particle size: 37–55 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 9% pH range: 2–8
Sep-Pak tC ₂ SiC ₂ H ₅	Weakly hydrophobic, silica-based bonded phase used in methods when less retention than that of C ₈ is required. Trifunctional bonding chemistry for increased hydrolytic stability.	<ul style="list-style-type: none"> Applications are similar to those of C₁₈ and C₈ 	Particle size: 37–55 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 2.7% pH range: 2–8

Reversed or Normal Phase			
	Description	Applications	Properties
Sep-Pak Aminopropyl Si(CH ₂) ₃ NH ₂	Moderately polar, silica-based bonded phase with weakly basic surface. Can be used as a polar sorbent with different selectivity for acidic/basic analytes or as a weak anion exchanges in aqueous medium below pH 8.	<ul style="list-style-type: none"> Phenols, phenolic pigments, natural products Petroleum fractionation Saccharides Drugs and drug metabolites JPMHLW official methods for pesticides in food 	Particle size: 55–105 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 3.5% pH range: 2–8
Sep-Pak Cyanopropyl Si(CH ₃)(CH ₂) ₃ (CN)	Silica-based bonded phase with low hydrophobicity. Can be used as a less polar alternative to silica or as a less hydrophobic alternative to C ₁₈ or C ₈ .	<ul style="list-style-type: none"> Drugs and their metabolites Pesticides 	Particle size: 55–105 μm Pore size: 125Å Surface area: 325 m ² /g Carbon load: 6.5% pH range: 2–8
Sep-Pak Diol Si(CH ₂) ₃ OCH ₂ CH(OH)CH ₂ OH	Moderately polar, neutral, silica-based bonded phase. Used in normal-phase applications where acidic character of silica is undesirable or as a weakly hydrophobic phase in aqueous media.	<ul style="list-style-type: none"> Antibiotics in cosmetics Protein and peptide isolation by HIC (hydrophobic-interaction chromatography) 	Particle size: 37–55 μm Pore size: 300Å Surface area: 100 m ² /g Carbon load: 2% pH range: 2–8

Normal Phase			
	Description	Applications	Properties
Sep-Pak Silica SiO ₂	Polar sorbent binds analytes in non-aqueous solvents. Also used as an intermediate-strength cation exchanges in aqueous media and as a support for liquid-liquid partition separations.	<ul style="list-style-type: none"> Vitamins and food additives Lipid classification Synthetic organic compounds Natural products, plant pigments JPMHLW official methods for pesticides in food 	Particle size: 55–105 μm Pore size: 125Å Surface area: 325 m ² /g Activity: High (≤ 3.2% water)
Sep-Pak Alumina (A, B & N) Al ₂ O ₃	Highly surface-active polar, acidic (A), neutral (N), and basic (B) sorbents. Exhibits specific pi-electron interactions with aromatic hydrocarbons. Acidic and basic alumina are also low-capacity ion exchangers in aqueous media, unaffected by high-energy radioactivity.	<ul style="list-style-type: none"> Petroleum, synthetic crude oil fractionation (N) Radioactive compound isolation, isotope generators (A,B) Phospholipids, steroids, catecholamines (B) Food, feed additives (A,N), synthetic organic compounds (N) Pesticide, herbicide, priority pollutant isolation (N,B) Alternative to official AOAC and EPA methods (A,N,B) 	Particle size: 50–300 μm Pore size: 120Å Activity: High, ≤ 1 on Brockmann scale (≤ 1.5% water) pH of 10% aqueous slurry: A: 4 N: 7.5 B: 10
Sep-Pak Florisil MgO•SiO ₂	Polar, highly active, weakly basic sorbent for the adsorption of low to moderately polar species from non-aqueous solutions.	<ul style="list-style-type: none"> AOAC and EPA official methods for pesticides JPMHLW official methods for pesticides in food Polychlorinated biphenyls (PCBs) in transformer oil 	Particle size: 50–200 μm Pore size: 60Å Activity: High (≤ 2.5% water pH of 10% aqueous slurry: 8.5

Ion Exchange			
	Description	Applications	Properties
Sep-Pak Accell Plus QMA Strong Anion Exchanger $C(O)NH(CH_2)_3N(CH_3)_3^+ Cl^-$	Silica-based, hydrophilic, strong anion exchanger with large pore size used to extract anionic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"> Isolation of anionic proteins Acidic pigments in wine, fruit juices, food extracts Phenolic compounds Peptide pool fractionation Inorganic anions in environmental samples 	Particle size: 37–55 μm Pore size: 300Å pH range: 2–9 Carbon load: 6% Ligand density: 220 $\mu moles/g$
Sep-Pak Accell Plus CM Weak Cation Exchanger $COO^- Na^+$	Silica-based, hydrophilic, weak cation exchanger with large pore size used to extract cationic analytes in aqueous and non-aqueous solutions.	<ul style="list-style-type: none"> Isolation of cationic proteins Pesticides, herbicides Steroids Inorganic cations in environmental samples 	Particle size: 37–55 μm Pore size: 300Å pH range: 2–9 Carbon load: 5.5% Ligand density: 350 $\mu moles/g$

Application Specific			
	Description	Applications	Properties
PoraPak RDX Divinylbenzene/Vinylpyrrolidone	For the analysis of explosives in surface and ground water. Meets or exceeds requirements of EPA Method 8330. Reduces use of organic solvent by 10-fold. PoraPak RDX is a divinylbenzene/vinylpyrrolidone copolymer.	<ul style="list-style-type: none"> EPA Method 8330 Nitroaromatics, Nitroamines EPA Method 529 Explosives and related compounds 	Particle size: 125–150 μm Pore size: 200Å
Sep-Pak DNPH Diphenylhydrazine coated on silica	Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react in situ to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis.	<ul style="list-style-type: none"> EPA Method TO–11A; ASTM D5197 for carbonyl compounds in air JPMOE Official Methods for aldehydes: odor in outdoor air and in exhaust gas 	Particle size: 55–105 μm Pore size: 125Å Recommended maximum capacity: 75 μg (2.5 $\mu moles$) formaldehyde/cartridge
Sep-Pak XPoSure Aldehyde Sampler Diphenylhydrazine coated on silica	Acidified dinitrophenylhydrazine reagent coated on silica used for collection of air samples. Aldehydes and ketones react in situ to form hydrazone derivatives; these are then eluted and quantitated by HPLC analysis. Larger particle size optimized for low-pressure personal air monitors.	<ul style="list-style-type: none"> JPMHLW official methods for aldehydes in indoor air EPA Methods TO–11A and IP–6A, ASTM D5197 for carbonyl compounds in air NIOSH Method 2532 for glutaraldehyde in air 	Particle size: 500–1000 μm Pore size: 125Å Recommended maximum capacity: 70 μg (2.3 $\mu moles$) formaldehyde/cartridge
Sep-Pak Ozone Scrubber Potassium iodide	Potassium iodide cartridge is used in series with Sep-Pak DNPH and XPoSure Aldehyde Sampler cartridges to remove ozone interferences.	<ul style="list-style-type: none"> EPA Method IP–6A and ASTM D5197 for carbonyl compounds in air 	Quantity: 1.4 g KI Capacity: 4.2 mmoles ozone/cartridge (theoretical)
Sep-Pak Dry Anhydrous sodium sulfate	High-capacity desiccant used to remove residual water from normal-phase SPE extracts (in water-immiscible organic solvents).	<ul style="list-style-type: none"> General purpose 	Quantity: 2.85 g anhydrous Na_2SO_4 Theoretical capacity: 3.6 g H_2O
Sep-Pak PS2 Styrene–DVB copolymer	Very hydrophobic copolymer designed for multi-residue pesticide analysis in water samples.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in water JPMHLW official methods for pesticides in food 	Particle size: 80 μm Quantity: 265 mg/cartridge
Sep-Pak AC2 Activated carbon	Highly hydrophobic, low ash content, activated carbon used to remove or enrich very polar organic molecules from water.	<ul style="list-style-type: none"> JPMHLW official method for 1,4-dioxane analysis in water Pesticides, herbicides, esp. highly polar small molecules 	Particle size: 85 μm Quantity: 400 mg/cartridge
Sep-Pak Carbon Black/Aminopropyl Carbon black Aminopropyl silica	Two-layer sorbent bed used for pesticide cleanup in food matrices prior to GC analysis.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in food JPMHLW official method for prophan 	Particle size: 37–105 μm (carbon black, top layer); 55–105 μm (aminopropyl silica, bottom layer) Quantity: 500 mg of each sorbent, separated by frit
Sep-Pak Carbon Black/PSA Primary-secondary amine silica	Two-layer sorbent bed used for pesticide clean-up in food matrices prior to GC analysis. PSA provides alternative selectivity compared to aminopropyl.	<ul style="list-style-type: none"> JPMHLW official methods for pesticides in food 	Particle size: 37–105 μm (carbon-black, top layer); 37–55 μm (PSA, bottom layer) Quantity: 500 mg of each sorbent, separated by frit

Sep-Pak Cartridge Selection Guide



	Plus Short	Plus Long	Plus Light	Classic Short	Classic Long	Vac 1 cc/50 mg	Vac 1 cc/100 mg	Vac RC/100 mg
	50/box	50/box	50/box	50/box	50/box	100/box	100/box	50/box
Sorbent	Part No. Mass/Volume ^e	Part No. Mass/Volume ^e	Part No. Mass/Volume ^e	Part No. Mass/Volume ^e	Part No. Mass/Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e
C ₁₈	WAT020515 360 mg/0.7 mL	WAT023635 820 mg/1.6 mL	WAT023501 130 mg/0.3 mL	WAT051910 360 mg/0.85 mL	—	WAT054955 0.13 mL	WAT023590 0.2 mL	WAT036935 0.2 mL
tC ₁₈	WAT036810 400 mg/0.8 mL	WAT036800 900 mg/1.4 mL	WAT036805 145 mg/0.4 mL	—	—	WAT054960 0.11 mL	WAT036820 0.25 mL	WAT043410 0.25 mL
C ₈	WAT036775 400 mg/0.8 mL	—	WAT036770 145 mg/0.4 mL	—	—	WAT054965 0.11 mL	WAT036785 0.25 mL	WAT043415 0.25 mL
tC ₂	WAT052720 400 mg/0.8 mL	—	WAT052725 145 mg/0.4 mL	—	—	—	WAT052710 0.25 mL	—
Silica	—	WAT020520 690 mg/1.6 mL	WAT023537 120 mg/0.4 mL	—	WAT051900 690 mg/2.0 mL	WAT054980 0.15 mL	WAT023595 0.25 mL	WAT036940 0.25 mL
Florisil	—	WAT020525 910 mg/1.4 mL	WAT023543 145 mg/0.3 mL	—	WAT051960 900 mg/1.7 mL	WAT054985 0.12 mL	WAT023600 0.2 mL	—
Accell Plus CM	WAT020550 360 mg/0.8 mL	—	WAT023531 130 mg/0.4 mL	WAT010910 360 mg/1.1 mL	—	—	WAT023625 0.25 mL	—
Accell Plus QMA	WAT020545 360 mg/0.8 mL	—	WAT023525 130 mg/0.4 mL	WAT010835 360 mg/1.1 mL	—	—	WAT023620 0.25 mL	WAT043460 0.25 mL
Alumina A	—	WAT020500 1710 mg/1.2 mL	WAT023549 280 mg/0.35 mL	—	WAT051800 1850 mg/1.8 mL	—	WAT023575 0.1 mL	—
Alumina B	—	WAT020505 1710 mg/1.2 mL	WAT023555 280 mg/0.35 mL	—	WAT051820 1850 mg/1.8 mL	—	WAT023580 0.1 mL	—
Alumina N	—	WAT020510 1710 mg/1.2 mL	WAT023561 280 mg/0.35 mL	—	WAT051810 1850 mg/1.8 mL	—	WAT023585 0.1 mL	—
Aminopropyl (NH ₂)	WAT020535 360 mg/0.7 mL	—	WAT023513 130 mg/0.3 mL	WAT010830 360 mg/0.85 mL	—	—	WAT023610 0.2 mL	WAT043475 0.2 mL
Cyanopropyl (CN)	WAT020540 360 mg/0.7 mL	—	WAT023507 130 mg/0.3 mL	WAT010823 360 mg/0.85 mL	—	WAT054975 0.13 mL	WAT023615 0.2 mL	—
PSA	186004538 360 mg/0.7 mL	—	186004578 130 mg/0.3 mL	186004560 360 mg/0.85 mL	—	186004562 0.1 mL	186004561 0.2 mL	186004567 0.2 mL
Diol	WAT020530 360 mg/0.8 mL	—	WAT023519 130 mg/0.4 mL	—	—	—	WAT023605 0.25 mL	WAT043480 0.25 mL

^eHold up volume

Sep-Pak Specialty Chemistries

Description	Mass/Volume/Type	Qty.	Part No.
Air Testing			
Sep-Pak DNPH-Silica Cartridge	350 mg/0.7 mL/Plus Short	20/box	WAT037500
Sep-Pak DNPH-Silica Cartridge	800 mg/1.6 mL/Plus Long	20/box	WAT039550
Sep-Pak XPoSure Aldehyde Sampler Cartridge	350 mg/0.7 mL/Plus Short	20/box	WAT047205
Sep-Pak Ozone Scrubber Cartridge	1.4 g/1.6 mL/Plus Short	20/box	WAT054420



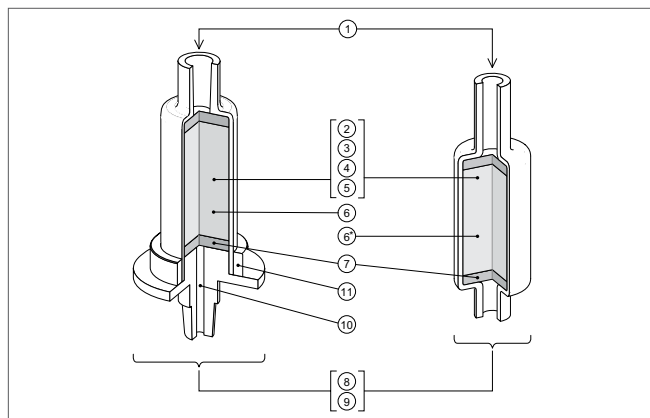
	Vac 3 cc/200 mg	Vac 3 cc/500 mg	Vac RC/500 mg	Vac 6 cc/500 mg	Vac 6 cc/1 g	Vac 12 cc/2 g	Vac 20 cc/5 g	Vac 35 cc/10 g
	50/box	50/box	50/box	30/box	30/box	20/box	20/box	10/box
Sorbent	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e	Part No. Volume ^e
C ₁₈	WAT054945 0.42 mL	WAT020805 0.8 mL	WAT036945 0.8 mL	WAT043395 1.2 mL	WAT036905 2.0 mL	WAT036915 3.6 mL	WAT036925 8.0 mL	WAT043345 16.8 mL
tC ₁₈	WAT054925 0.34 mL	WAT036815 1.0 mL	WAT043425 1.0 mL	WAT036790 1.1 mL	WAT036795 1.9 mL	WAT043380 3.5 mL	WAT043365 7.8 mL	WAT043350 16.3 mL
C ₈	WAT054940 0.34 mL	WAT036780 1.0 mL	WAT043430 1.0 mL	WAT054525 1.1 mL	WAT054570 1.9 mL	WAT054615 3.5 mL	WAT054660 7.8 mL	WAT054700 16.3 mL
tC ₂	—	WAT052715 1.0 mL	—	—	WAT052705 1.9 mL	—	—	—
Silica	WAT054930 0.53 mL	WAT020810 1.2 mL	WAT036950 1.2 mL	WAT043400 1.2 mL	WAT036910 1.9 mL	WAT036920 3.9 mL	WAT036930 11.0 mL	WAT043355 23.4 mL
Florisil	—	WAT020815 0.8 mL	WAT043435 0.8 mL	WAT043405 1.2 mL	WAT043390 2.0 mL	WAT043385 3.6 mL	WAT043370 8.0 mL	WAT043360 16.8 mL
Accell Plus CM	—	WAT020855 1.1 mL	WAT054505 1.1 mL	WAT054545 1.2 mL	WAT054590 1.9 mL	WAT054635 3.5 mL	WAT054675 7.8 mL	WAT054720 16.3 mL
Accell Plus QMA	—	WAT020850 1.1 mL	WAT054500 1.1 mL	WAT054550 1.2 mL	WAT054595 1.9 mL	WAT054640 3.5 mL	WAT054680 7.8 mL	WAT054725 16.3 mL
Alumina A	—	WAT020820 0.4 mL	—	WAT054535 0.5 mL	WAT054580 0.8 mL	WAT054620 1.8 mL	WAT054670 3.9 mL	WAT054710 8.2 mL
Alumina B	—	WAT020825 0.4 mL	—	WAT054540 0.5 mL	WAT054585 0.8 mL	WAT054625 1.8 mL	WAT054665 3.9 mL	WAT054715 8.2 mL
Alumina N	—	WAT020830 0.4 mL	WAT043485 0.4 mL	WAT054530 0.5 mL	WAT054575 0.8 mL	WAT054630 1.8 mL	WAT043375 3.9 mL	WAT054705 8.2 mL
Aminopropyl (NH ₂)	—	WAT020840 0.8 mL	WAT054515 0.8 mL	WAT054560 1.2 mL	WAT054605 2.0 mL	WAT054650 3.6 mL	WAT054695 8.0 mL	WAT054740 16.8 mL
Cyanopropyl (CN)	WAT054935 0.42 mL	WAT020835 0.8 mL	—	WAT054555 1.2 mL	WAT054600 2.0 mL	WAT054645 3.6 mL	WAT054685 8.0 mL	WAT054730 16.8 mL
PSA	186004598	186004536 0.8 mL	186004568 0.8 mL	186004563 1.2 mL	186004537 2.0 mL	186004564 3.6 mL	186004565 8.0 mL	186004566 16.8 mL
Diol	—	WAT020845 1.0 mL	WAT054520 1.0 mL	WAT054565 1.1 mL	WAT054610 1.9 mL	WAT054655 3.5 mL	WAT054690 7.8 mL	WAT054735 16.3 mL

^eHold up volume

Sep-Pak Specialty Chemistries

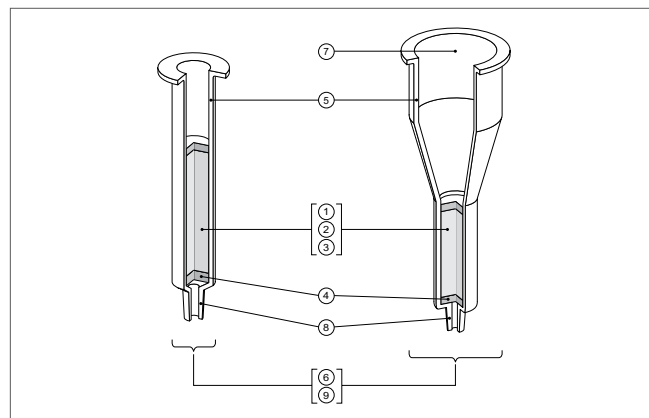
Description	Mass/Volume/Type	Qty.	Part No.
Food, Environmental, and Biological Testing			
PoraPak RDX Cartridge	500 mg/1 mL/6 cc Vac	30/box	WAT047220
Sep-Pak Dry Cartridge	2.85 g/1.6 mL/Plus Long	50/box	WAT054265
Sep-Pak Carbon Black/Aminopropyl Cartridge	500 mg carbon black, 500 mg aminopropyl/1.4 mL/6 cc Vac	30/box	186003369
Sep-Pak Carbon Black/PSA Silica Cartridge	500 mg carbon black, 500 mg PSA/1.4 mL/6 cc Vac	30/box	186004590
Sep-Pak Accell Plus QMA Carbonate Cartridge	150 mg/0.4 mL/Plus Light	50/box	186004051
Sep-Pak Accell Plus QMA Carbonate Plus Light Cartridge	46 mg/0.15 mL/Plus Light	50/box	186004540

Anatomy of Sep-Pak Cartridges



The Anatomy of Sep-Pak Plus and Classic Cartridge Design

1. Female Luer inlet accepts male Luer tip. Plus cartridge design can be stacked.
2. Highest quality sorbents designed and made specifically for sample preparation; clean, dry, reproducible in activity and capacity with optimal surface area, pore and particle size distributions.
3. Broad range of sorbent surface activities available; each lot is tested under rigid specifications for chromatographic activity, retention, and selectivity.
4. Sorbent type and bed dimensions equal to corresponding Sep-Pak Classic Cartridges enable direct transfer of previously developed and published methods to new Plus design.
5. Weight of sorbent in each cartridge is controlled within +/- 5% of specification to assure reproducible performance.
6. Advanced bed formation to minimize voids and channels. 6 Patented* Radial Compression Technology used to form homogeneous packed bed free of voids and channels.
7. Special blend of HD and UHMW polyethylenes used for 20 µm frits imparts excellent solvent resistance, extremely low extractables level, and good flow properties. Frit also acts as depth filter for small amounts of sample debris.
8. Polyethylene body has excellent solvent resistance. All body parts are quality tested to verify extremely low level of UV-absorbing extractables. Plus design is molded for precise dimensions making it suitable for automated equipment.
9. Cartridges are sealed in a special polyfoil pouch to protect product integrity, sorbent activity, and purity.
10. Male Luer outlet has reduced internal volume for minimal sample hold-up.
11. Color-coded ring compresses and seals the cartridge and identifies sorbent.



The Anatomy of Sep-Pak Vac and Vac RC Cartridge Designs

1. Highest quality sorbents design and made specially for sample preparation; clean, dry, reproducible in activity and capacity, with optimal surface area, pore and particle size.
2. Broad range of sorbent surface activities available; each lot is tested under rigid specifications for chromatographic activity, retention, and selectivity.
3. Weight of sorbent in each cartridge is controlled within +/- 5% of specification to assure reproducible performance.
4. Special blend of HD and UHMW polyethylenes used for 20 µm frits.
5. Molded, medical-grade polypropylene body.
6. Cartridges are sealed in a special polyfoil pouch to protect products integrity, sorbent activity, and purity.
7. Integral reservoir approximately 20 mL, robotic compatible.
8. Outlet make Luer tip.
9. Color-coded labeling in the cartridge to identify the sorbent.

* P.D. McDonald, C.W. Rausch, Radial Compression of Packed Beds, U.S. Patent # 4,250,035 (1981); Great Britain # 1,568,700 (1976); Canada # 1,101,785 (1981); Japan # 1,400,983 (1987); Sweden # 450,750 (1987); Germany # 2,655,650 (1988); other patents pending.

General Extraction Protocols for Sep-Pak Cartridges

Normal-Phase Chromatography with Sep-Pak Cartridges

To perform normal-phase chromatography with Sep-Pak Cartridges, use a gradient of nonpolar solvents with polar Silica, Florisil, NH₂, Diol, CN, Alumina A, B, or N as a sorbent*.

1. You may condition the cartridge with 6–10 hold-up volumes of nonpolar solvent, usually the sample solvent.
2. Load the sample into the cartridge.
3. Elute unwanted components with a nonpolar solvent.
4. Elute the first component of interest with a polar solvent.
5. Elute remaining components of interest with progressively more polar solvents.
6. When you recover all of your components, discard the used cartridge in an appropriate manner.

* Depending upon your chromatographic conditions, you may also use CN as a packing material for normal-phase chromatography.

Reversed-Phase Chromatography with Sep-Pak Cartridges

To perform reversed-phase chromatography with Sep-Pak Cartridges, use a gradient of strongly to weakly polar solvents with nonpolar C₁₈, tC₁₈, C₈, tC₈, Diol, NH₂, or CN as a sorbent.

1. Solvate the bonded phase with 6–10 cartridge hold-up volumes of methanol or acetonitrile. Flush the cartridge with 6–10 hold-up volumes of water or buffer. Do not allow the cartridge to dry out.
2. Load the sample dissolved in a strongly polar solvent.
3. Elute unwanted components with a strongly polar solvent.
4. Elute weakly held components of interest with a less polar solvent.
5. Elute more tightly bound components with progressively more nonpolar solvents.
6. When you recover all of your components, discard the used cartridge in an appropriate manner.

Ion-Exchange Chromatography with Sep-Pak Cartridges

To perform ion-exchange chromatography with Sep-Pak Cartridges, use a gradient of pH or ionic strength with Accell Plus CM, Accell Plus QMA, or NH₂ as a sorbent.

1. Condition the cartridge with 6–10 held-up volumes of deionized water or weak buffer.
2. Load the sample dissolved in a solution of deionized water or buffer.
3. Elute unwanted weakly bound components with a weak buffer.
4. Elute the first component of interest with a stronger buffer (change the pH or ionic strength).
5. Elute other components of interest with progressively stronger buffers.
6. When you recover all of your components, discard the used cartridge in an appropriate manner.

General Elution Protocol for Normal-Phase Chromatography on Sep-Pak Cartridges (Silica, Alumina, Florisil, Diol, NH₂)

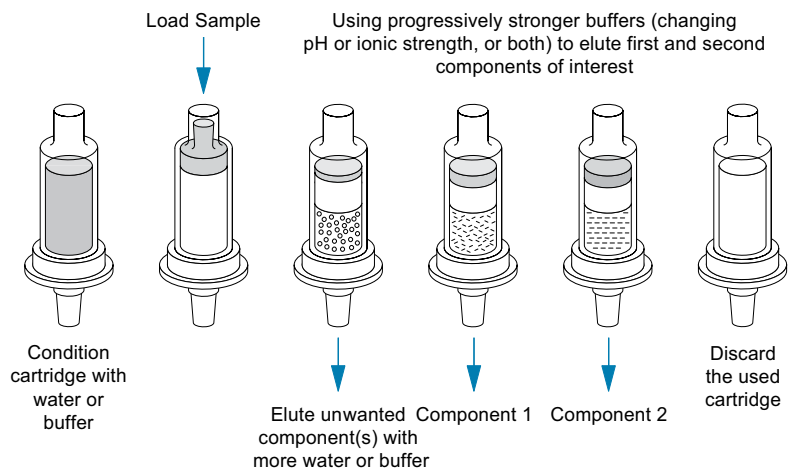
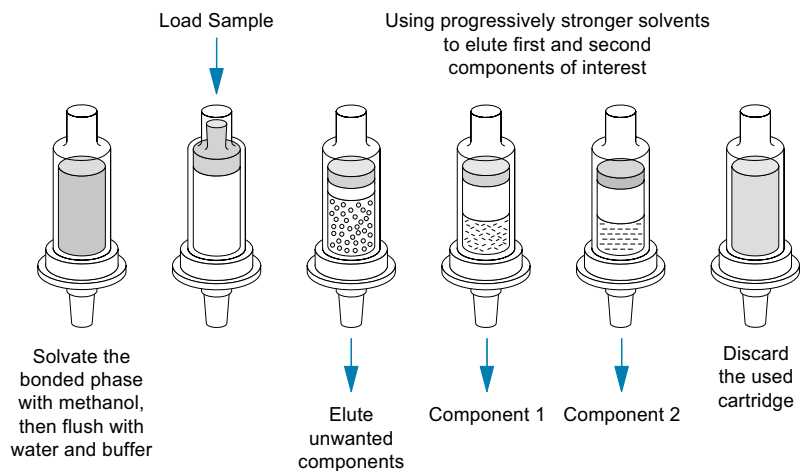
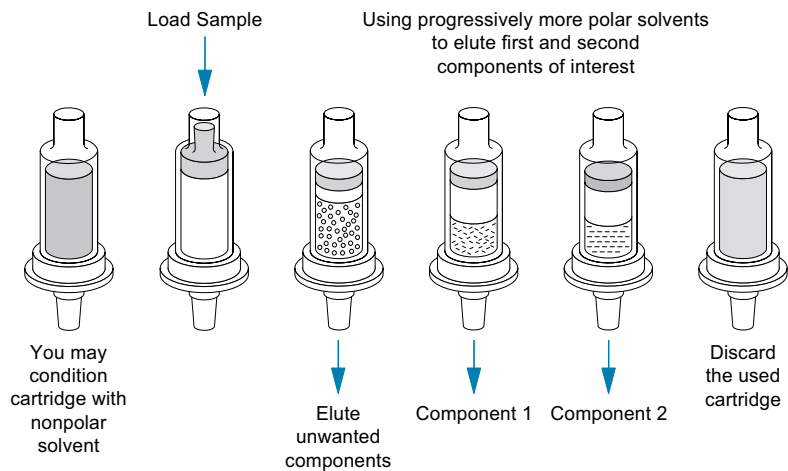
1. Load sample.
2. Use progressively more polar solvents to elute first and second components of interest.
3. You may condition cartridge with nonpolar solvent.
4. Elute unwanted components.
5. Elute first component of interest (Component 1).
6. Elute second component of interest (Component 2).
7. Discard the used cartridge.

General Elution Protocol for Reversed-Phase Chromatography on Sep-Pak Cartridges (C₁₈, CN)

1. Load sample.
2. Use progressively stronger solvents to elute first and second components of interest.
3. Solvate the bonded phase with methanol, then flush with water and buffer.
4. Elute unwanted components.
5. Elute first component of interest (Component 1).
6. Elute second component of interest (Component 2).
7. Discard the used cartridge.

General Elution Protocol for Ion-Exchange Chromatography on Sep-Pak Cartridges (NH₂, Accell Plus QMA, Accell Plus CM)

1. Load sample.
2. Use progressively stronger buffers (changing pH or ionic strength) to elute first and second components of interest.
3. Condition cartridge with water or buffer.
4. Elute unwanted component(s) with more water or buffer.
5. Elute first component of interest (Component 1).
6. Elute second component of interest (Component 2).
7. Discard the used cartridge.



Sep-Pak DNPH-Silica Cartridges for Analyzing Formaldehyde, Other Aldehydes and Ketones in Air

Formaldehyde and other aldehydes are receiving increasing attention both as toxic substances and as promoters in the photochemical formation of ozone in air. Sources of aldehydes in residential buildings include plywood and particle board, insulation, combustion appliances, tobacco smoke, and various consumer products. Aldehydes are released into the atmosphere in the exhaust of motor vehicles and other equipment in which hydrocarbon fuels are incompletely burned.

The most sensitive and specific method for analyzing aldehydes and ketones is based on their reaction with 2,4-dinitrophenylhydrazine (DNPH) and subsequent analysis of the hydrazone derivatives by HPLC. The hydrazones may be detected by absorbance in the ultraviolet region, with maximum sensitivity obtained between 350 and 380 nm.

Airborne aldehydes have traditionally been collected by drawing a sample through an impinger containing a solution of DNPH. However, the impinger collector is generally cumbersome to use and is not well suited for high flow rates or extended collection times due to solvent evaporation.

The Sep-Pak DNPH-silica Cartridges meet the requirements of EPA Method TO-11A and provide a convenient device for sample collection. Using a vacuum pump, an air sample is drawn through the Sep-Pak DNPH-silica Cartridge. The aldehydes and ketones react with the DNPH and form the hydrazone derivative, which is retained on the cartridge. Later, the hydrazones are eluted from the cartridge with acetonitrile and analyzed by HPLC. Detection limits can be as low as 3 ppbv for a 100 liter sample.

Advantages of Sep-Pak DNPH-Silica Cartridges

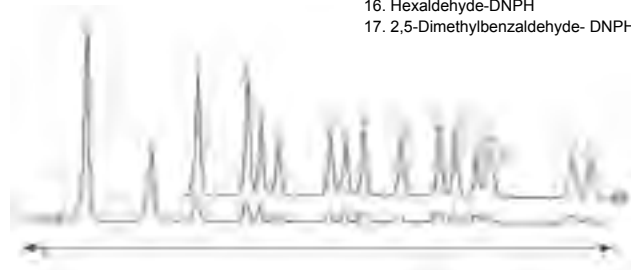
These cartridges provide you with significant advantages when compared to other techniques, such as liquid impingers, for the analysis of aldehydes and ketones. In addition, a new high speed, high resolution HPLC application has been developed to provide excellent quantitation capability in the low parts-per-billion range.

- Sep-Pak DNPH-silica Cartridges meet the requirements of EPA Method TO-11A and ASTM-D-5791-1.
- Results from impingers and these cartridges are in excellent agreement.
- Solvent consumption, solvent exposure and hazardous waste disposal costs are reduced.
- Sep-Pak DNPH-silica Cartridges provide superior convenience and reproducibility, making them ideal for field sampling and process monitoring applications.
- Sep-Pak DNPH-silica Cartridges can save time and increase productivity.
- Increased safety.



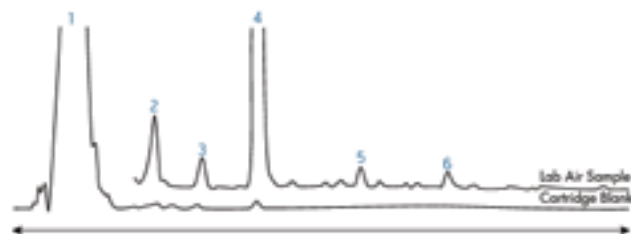
HPLC Separation of DNPH Derivatives of Common Aldehydes and Ketones

Column:	Nova-Pak C ₁₈ , 4 µm, 3.9 x 150 mm	Compounds:
Part number:	WAT086344	1. DNPH
Sample:	Mixture of DNPH and DNPH derivatives in acetonitrile.	2. Formaldehyde-DNPH
Mobile phase A:	Water/acetonitrile/tetrahydrofuran 60/30/10 v/v/v	3. Acetaldehyde-DNPH
Mobile phase B:	Water/acetonitrile 40/60 v/v 3 mL	4. Acetone-DNPH
Gradient:	100% A for 1 min., then linear gradient from 100% A to 100% B in 10 min.	5. Acrolein-DNPH
Flow rate:	1.5 mL/min	6. Propionaldehyde-DNPH
Injection:	20 µL	7. Crotonaldehyde-DNPH
Detection:	360 nm	8. Butanone-DNPH
		9. Butyraldehyde-DNPH
		10. Benzaldehyde-DNPH
		11. Isovaleraldehyde-DNPH
		12. Valeraldehyde-DNPH
		13. o-Tolualdehyde-DNPH
		14. m-Tolualdehyde-DNPH
		15. p-Tolualdehyde-DNPH
		16. Hexaldehyde-DNPH
		17. 2,5-Dimethylbenzaldehyde-DNPH



Low Level: Aldehyde Profile from Laboratory Air

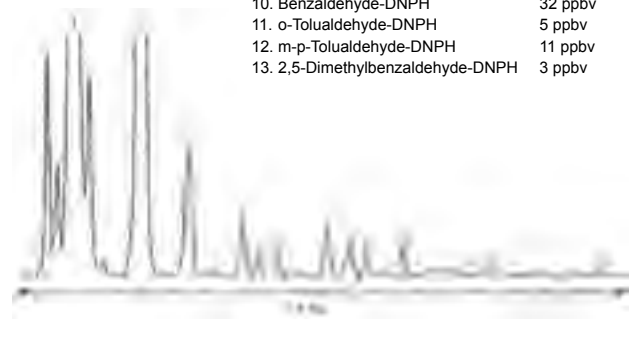
Lab Air Sample		Cartridge Blank (calculated for 100 liter sample)	
1. DNPH		1. DNPH	
2. Formaldehyde-DNPH	4.8 ppbv	2. Formaldehyde-DNPH	0.35 ppbv
3. Acetaldehyde-DNPH	1.2 ppbv	3. Acetaldehyde-DNPH	0.27 ppbv
4. Acetone-DNPH	118.0 ppbv	4. Acetone-DNPH	0.34 ppbv
5. Butanone-DNPH	0.8 ppbv		
6. Isovaleraldehyde-DNPH	0.7 ppbv		



The sample was obtained in a chemical research laboratory using a portable sampling pump. One hundred liters of air was drawn through the cartridge at 0.65 L/min. The sample was found to contain low concentration of formaldehyde (4.8 ppbv), acetaldehyde (1.2 ppbv) and methyl ethyl ketone (0.8 ppbv), but a significant amount of acetone (118 ppbv). Significant concentrations of acetone are frequently found in laboratories because of its widespread use as a solvent.

High Level: Aldehyde Profile from Diluted Auto Exhaust Emissions

Sample (8.4 L at 1 L/min) collected at US EPA Atmospheric Research Assessment Lab. Courtesy of Dr. S. B. Tejada.	Compounds:	
	1. DNPH	
	2. Formaldehyde-DNPH	2290 ppbv
	3. Acetaldehyde-DNPH	367 ppbv
	4. Acetone-DNPH	26 ppbv
	5. Acrolein-DNPH	8 ppbv
	6. Propionaldehyde-DNPH	12 ppbv
	7. Crotonaldehyde-DNPH	36 ppbv
	8. 2-Butanone-DNPH	24 ppbv
	9. Butyraldehyde-DNPH	15 ppbv
	10. Benzaldehyde-DNPH	32 ppbv
	11. o-Tolualdehyde-DNPH	5 ppbv
	12. m-p-Tolualdehyde-DNPH	11 ppbv
	13. 2,5-Dimethylbenzaldehyde-DNPH	3 ppbv



Sep-Pak DNPH-Silica Cartridge

Description	Qty.	Part No.
Sep-Pak DNPH-Silica Short Body Cartridge	20/box	WAT037500
Sep-Pak DNPH-Silica Long Body Cartridge	20/box	WAT039550

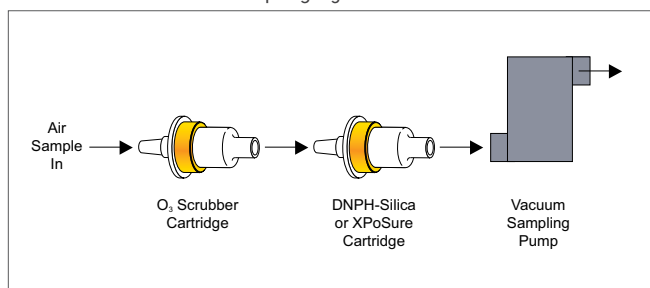
Ozone Scrubber Cartridges

Ozone has been shown to interfere with the analysis of carbonyl compounds in air samples that have been drawn through cartridges containing silica-coated with 2,4-dinitrophenylhydrazine (DNPH). Ozone Scrubber Cartridges are designed to remove this ozone interference.

These disposable devices are intended for use in series combination with the Waters Sep-Pak DNPH-Silica Cartridges or XPOsure Aldehyde Sampler Cartridges. One Ozone Scrubber Cartridge replaces the 1/4" diameter by 36" long copper ozone denuder located in the heated zone of sampling systems used for outdoor air monitoring (PAMS program).

Each Sep-Pak Ozone Scrubber Cartridge contains 1.4 g of granular potassium iodide. When air containing ozone is drawn through this packed bed, iodide is oxidized to iodine, consuming the ozone. The theoretical capacity of a single cartridge is 4.2 mmoles of ozone (200 mg). The particle size of the potassium iodide granules is optimized for good mass transfer and flow characteristics.

Flow Schematic for Air Sampling System



Sep-Pak Ozone Scrubber

Description	Qty.	Part No.
Sep-Pak Ozone Scrubber	20/box	WAT054420

Sep-Pak XPOsure Aldehyde Sampler Cartridges for Monitoring Aldehydes in Indoor Air

Based on an extension of our DNPH coating technology, Sep-Pak XPOsure Aldehyde Sampler Cartridges are the most sensitive active samplers available today.

Highest Sensitivity

Compared to existing sampling tube technology which have high and variable backgrounds, Sep-Pak XPOsure Cartridges are guaranteed to give consistent low aldehyde backgrounds, cartridge-to-cartridge, lot-to-lot.

High Collection Efficiencies

You can achieve >95% collection efficiencies for all aldehydes at flows of up to a liter per minute. And, you only need to use one cartridge—no breakthrough bed is necessary.

Low Pressure Drop—Use with Portable Personal Sampling Pumps

Large particle size and higher porosity frits make the Sep-Pak XPOsure Cartridge compatible with personal sampling pumps.

Easy-to-Use

Sample, elute, and shoot, it's that easy. You'll never have to break open and manipulate a glass tube again. And because the cartridges are made from high density polyethylene (HDPE), breakage is not a concern.

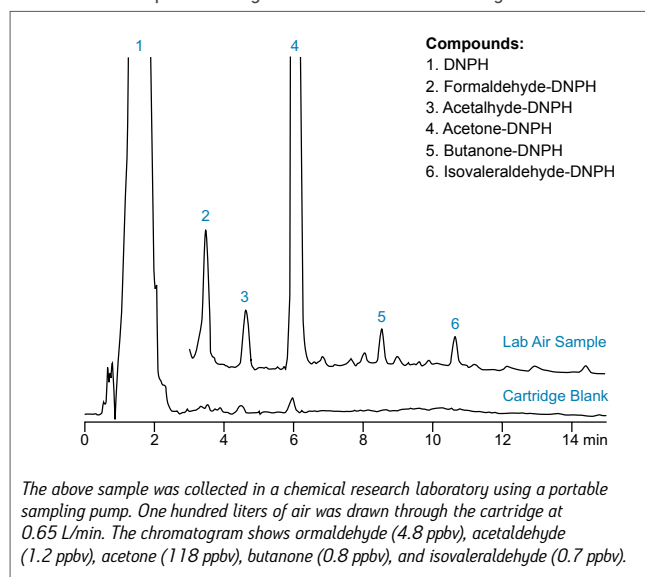
The figure on the right shows two traces. An actual cartridge blank demonstrating extremely low background levels and as an actual laboratory air sample.



Sep-Pak XPOsure Aldehyde Sampler Cartridge

Description	Qty.	Part No.
Sep-Pak XPOsure Aldehyde Sampler Cartridge	20/box	WAT047205

Low-Level Example: Aldehyde Profile from Laboratory Air



PoraPak RDX Sep-Pak Extraction Cartridge for the Analysis of Explosives in Surface and Ground Waters

Designed to meet or exceed the QA/QC requirements of EPA Method 8330, the PoraPak RDX Sep-Pak Extraction Cartridge is ideal for environmental testing laboratories supporting Department of Defense remediation programs.

High Sensitivity

PoraPak Sep-Pak Cartridges contain PoraPak RDX resin, a specially prepared, specially cleaned divinylbenzene/vinylpyrrolidone copolymer, packed in a high purity polypropylene syringe barrel. With the lowest guaranteed backgrounds and the highest cartridge-to-cartridge, lot-to-lot consistency, the Waters PoraPak RDX Column is the most sensitive technology available today and allows you to perform analysis at sub ppb levels.

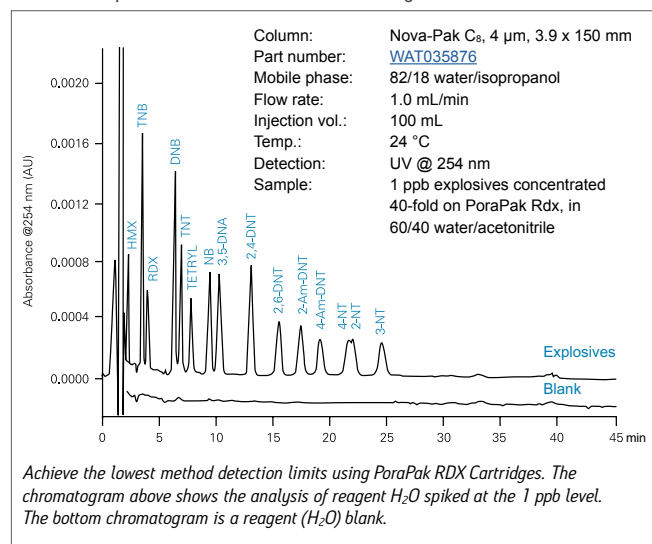
Unmatched Recoveries

The specially prepared resin is highly selective for nitroaromatic and nitramine compounds, resulting in recoveries of 90% or greater. Recovery data from preconcentrating 500 mL of explosives standards in sterile water at two concentrations on PoraPak RDX Sep-Pak Vac Columns. Number of replicates = 7.

Increase Productivity and Reduce Waste

By using PoraPak RDX Cartridges, you can reduce the amount of organic solvent used per sample by 10x and decrease your sample preparation time by 3x.

Isocratic Separation of Method 8330 Analytes



Activate, Load, Elute, and Shoot

- Flow: 15 mL acetonitrile through cartridge at 10 mL/min
- Flow: 30 mL water through cartridge at 10 mL/min
- Load: 500 mL water sample at 10 mL/min
- Elute: with 5 mL acetonitrile
- Dilute: to 40% acetonitrile with HPLC grade water
- Inject: 100 µL onto HPLC

Compound	1 ppb % Recovery	% RSD	10 ppb % Recovery	% RSD
HMX	100.5	6.7	100.5	3.9
TNB	95.9	3.5	99.3	3.3
RDX	90.9	6.4	98.7	3.2
DNB	99.5	3.2	99.2	3.2
TNT	97.0	3.0	102.	3.7
TETRYL	89.0	6.4	102.8	4.7
NB	96.5	2.5	97.9	2.8
3,5-DNA	91.2	3.3	98.2	3.6
2,4-DNT	97.3	3.4	99.9	3.4
2,6-DNT	94.5	3.4	98.7	3.4
2-Am-DNT	92.4	5.2	98.0	3.7
4-Am-DNT	90.0	4.9	97.2	4.1
4-NT	89.5	4.3	100.4	3.7
2-NT	96.8	6.6	93.4	3.0

PoraPak RDX Cartridges and Accessories

Description	Qty.	Part No.
PoraPak RDX Cartridges	30/box	WAT047220
Tubing, Tefzel [®] 1/8 in. OD x 0.040-in. I.D.	10 ft	WAT023344
Sep-Pak Vac adapter	12/box	WAT054260
60 cc Sep-Pak reservoir	12/box	186005587
Male-male adapter	100/box	WAT024310

Sep-Pak Dry SPE Cartridge

Sep-Pak Dry Cartridges are packed with 2.85 g of anhydrous sodium sulfate. These cartridges are designed to remove residual water from the SPE extract.



Sep-Pak Dry Cartridge

Description	Qty.	Part No.
Sep-Pak Dry Cartridge	50/box	WAT054265

CERTIFIED SEP-PAK SOLID-PHASE EXTRACTION (SPE) CARTRIDGES

As a pioneer in SPE, Waters has advanced SPE performance and quality by offering Certified Sep-Pak Sample Preparation Products. By manufacturing these devices to strict performance and cleanliness specifications, we ensure that the detection limits and performance of your analytical methods will not be compromised by interfering substances commonly found in SPE hardware.

Improve Workflow and Reduce Solvent Waste

Certified Sep-Pak Sample Preparation Devices are available in the most commonly used formats and sorbents to allow easy integration into your sample preparation protocol. Reduced background interferences reduce solvent waste by eliminating unnecessary solvent pre-washing steps that are often required for trace residue methods.



Manufacturing

Our world-class manufacturing facilities strive to improve quality expectations for SPE product performance. We manufacture under the highest quality standard in the industry including ISO 9001, ISO 13485 and current Good Manufacturing Practices (CGMP). Each Certified Sep-Pak Product is thoroughly QC tested.

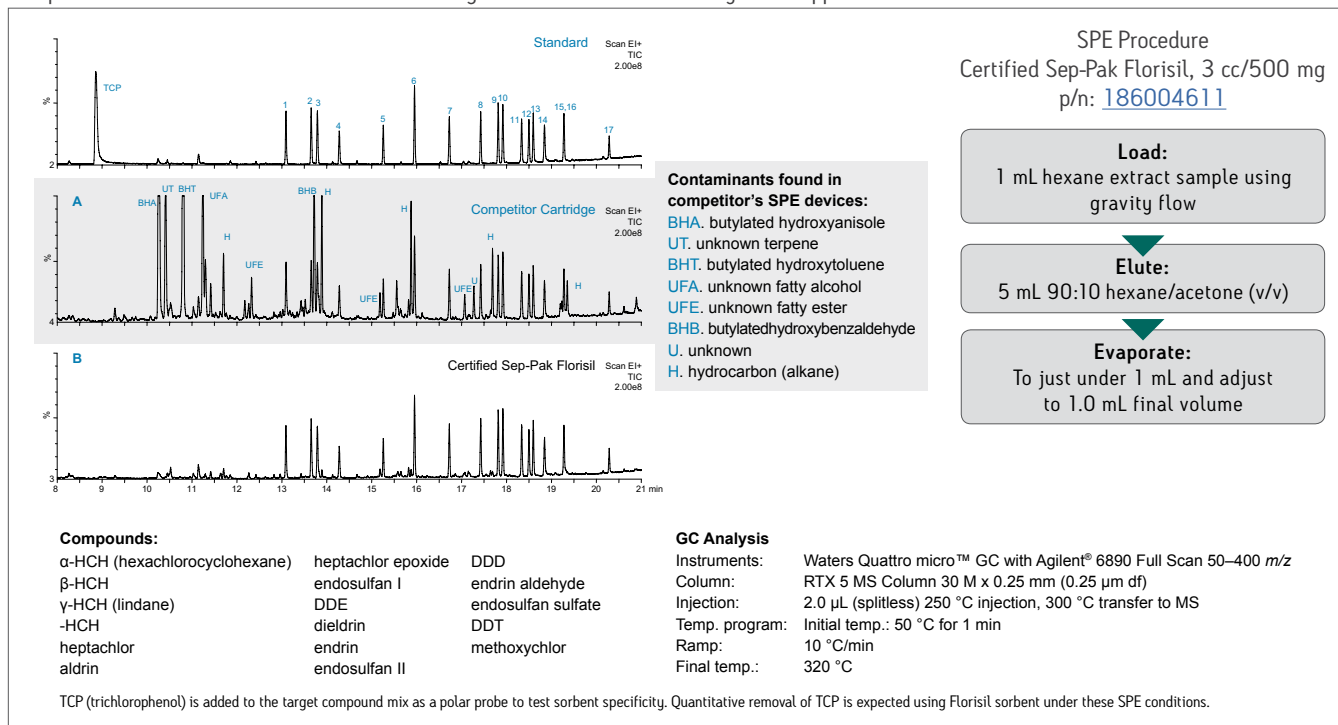
Sorbent specifications based on:

- Contaminants including hydrocarbons and other environmental contaminants
- Sorbent functionality including:
 - ligand density
 - particle size distribution
 - surface activity
- Chromatographic performance


Assembly specifications based on:

- Frits and barrels dimensional tolerance
- Chromatographic testing of total residual extractables including:
 - hydrocarbons
 - plasticizers
 - anti-oxidants
- Sorbent bed voiding
- Consistent sample flow characteristics

Comparison of Extracted Interference Levels in Organochlorine Pesticide Analysis at 1 ppm




Certified Sep-Pak Sorbent Selection Guide



C₁₈

- Silica-based, trifunctionally-bonded octadecyl sorbent.
- High carbon load provides excellent hydrolytic stability for a wide range of samples.
- Strong hydrophobic sorbent used to adsorb analytes of even weak hydrophobicity from aqueous solutions.
- Typical applications include drugs and their metabolites in serum, plasma or urine, desalting of peptides, trace organics in environmental water samples, organic acids in beverages.


	3 cc/200 mg	3 cc/500 mg	6 cc/500 mg	6 cc/1 g
Sorbent	50/box	50/box	30/box	30/box
C ₁₈	186004618	186004619	186004620	186004621



Alumina (A, B, N)

- Alumina very similar to silica; however, the alumina surface tends to be slightly more stable under high pH conditions than unfunctionalized silica.
- The aluminum oxide surface provides an extremely polar surface for analyte retention and has properties of a Lewis acid.
- Depending on the sorbent's surface treatment, alumina is available in three forms Alumina A, Alumina B, and Alumina N.
- Alumina exhibits specific interactions with the π -electrons of aromatic hydrocarbons, making it useful for applications like crude oil fractionation.
- Acidic and basic grades can be used as low-capacity ion exchangers.


	3 cc/200 mg	3 cc/500 mg	6 cc/500 mg	6 cc/1 g
Sorbent	50/box	50/box	30/box	30/box
Alumina A	—	186004602	186004603	186004604
Alumina B	—	186004605	186004606	186004607
Alumina N	—	186004608	186004609	186004610



Silica

- Unbonded, highly-activated silica stationary phase.
- A polar sorbent for analyte isolation from non-polar solvents like hydrocarbons and less polar esters and ethers.
- Analyte retention can occur through hydrogen bonding or dipole-dipole interactions in non-aqueous samples.
- Silica provides a slightly acidic surface for moderate cation-exchange interactions in aqueous samples.
- Elution with more polar solvents like polar esters, ethers, alcohols, acetonitrile, or water.

	3 cc/200 mg	3 cc/500 mg	6 cc/500 mg	6 cc/1 g
Sorbent	50/box	50/box	30/box	30/box
Silica	186004614	186004615	186004616	186004617



Florisil

- Very-polar, highly-active, weakly-basic sorbent for adsorption of low to moderate polarity species from non-aqueous solutions.
- Specifically designed for the adsorption of pesticides using official AOAC, EPA, and JPMHLW regulated methods.
- Applications include polychlorinated biphenyls (PCBs) in transformer oil.

	3 cc/200 mg	3 cc/500 mg	6 cc/500 mg	6 cc/1 g
Sorbent	50/box	50/box	30/box	30/box
Florisil	—	186004611	186004612	186004613

Did you know...

Strategies for Isolating and Cleaning Up Analytes of Interest

Two general SPE strategies are implemented for isolating and cleaning up sample components of interest. A retention-cleanup-elution strategy is frequently used when the compounds of interest are present in levels too low for accurate and precise quantitation. Concentration of dilute samples and trace enrichment of compounds are achieved by this strategy. A pass-through cleanup strategy may be chosen when the desired sample component is present at a high concentration. However, no sample enrichment occurs when a pass-through cleanup strategy is used.

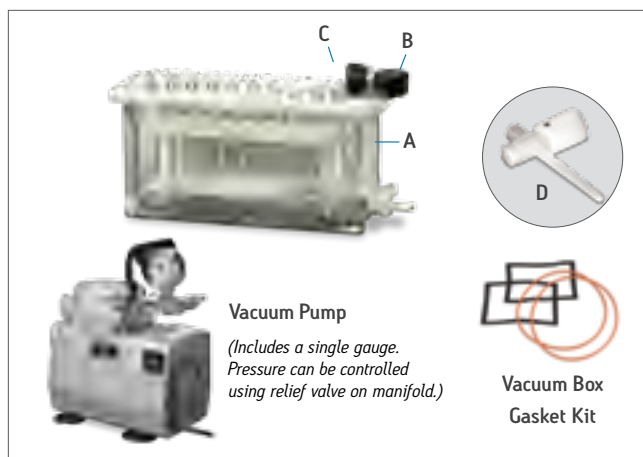
ACCESSORIES

Waters Vacuum Manifold for Use with SPE Cartridges

The vacuum manifold has the capacity to process up to twenty samples simultaneously. The extraction manifold has enhanced features designed for use with conventional silica-based, SPE cartridges as well as modifications that allow you take full advantage of the unique performance characteristics of our Oasis HLB Extraction Cartridges.

This manifold offers:

- Precision-machined Delrin® cover with alignment posts for quick and easy alignment with test tube rack.
- Vacuum gauge placement on cover, not in fluid path allows for quick and easy waste removal at bottom by vacuum.
- Enhanced vacuum control valve designed for use with Waters Oasis HLB Extraction Cartridges, allows for a quick and momentary rise in vacuum above the frit bubble point at the touch of a finger.
- High purity polypropylene needle valves and needle tips with minimum dead volume (opening and closing the valves is required to prevent silica-based SPE cartridges from drying out).

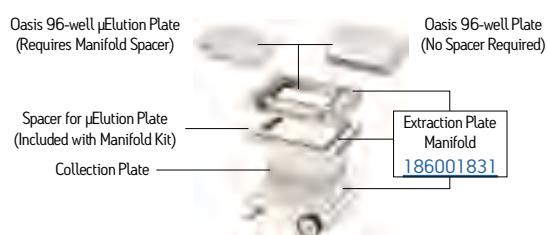


Vacuum Pump
(Includes a single gauge.
Pressure can be controlled
using relief valve on manifold.)

**Vacuum Box
Gasket Kit**

Spare Parts for the Waters Extraction Manifolds		
Description	Qty.	Part No.
Needle Valves, (required when using silica-based SPE cartridges) (not required for use with extraction cartridges)	20/pk	WAT200685
Needle Tips	20/pk	WAT200691
Cover, 20 Position without Gauge Assembly	—	WAT200686
Gauge Assembly, Vacuum	—	WAT200687
Reservoir, Glass with Outlet Valve	—	WAT200688
Outlet Valve Kit	—	WAT200689
Gasket for Cover	—	WAT200690
Ejector Tool	—	WAT058839
Luer Plugs	25/pk	WAT058851
Rubber Ball Ring (for vacuum gauge assembly)	—	WAT058840
Reversible Vial Rack for 1 mL or 4 mL autosampler vials	—	WAT058871
2 mL Vial Rack for Manifold	—	186005234
13 x 75 mm Test Tube Rack	—	WAT200678
13 x 100 mm Test Tube Rack	—	WAT200679
16 x 75 mm Test Tube Rack	—	WAT200680
16 x 100 mm Test Tube Rack	—	WAT200681
Reservoir, 30 cc (for Plus, Light, Vac, and classic cartridges)	48/pk	WAT011390
Reservoir, 60 cc (for Plus, Light, and Vac cartridges)	12/pk	186005587
Adapter, Male-male Luer (for classic cartridges)	100/pk	WAT024310
Adapter (to attach reservoir to 1, 3, and 6 cc Vac cartridges)	12/pk	WAT054260
Adapter (to attach reservoir to 12, 20, and 35 cc Vac cartridges)	10/pk	WAT048160
Vacuum Pump (110 V, 60 Hz)	—	725000417
Vacuum Pump (220 V, 50 Hz)	—	725000604

Manifold and Accessories for Extraction Plate

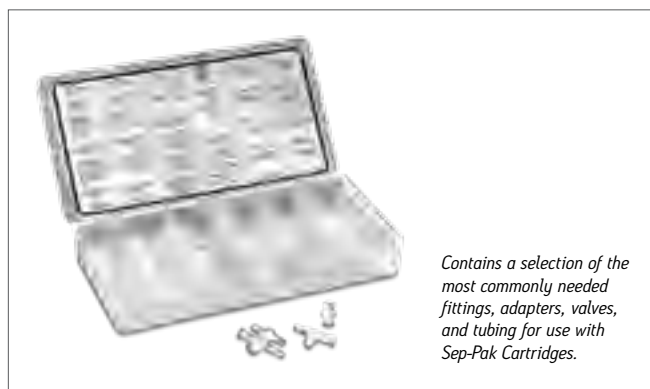


Description	Qty.	Part No.
Extraction Plate Manifold for Oasis 96-well Plates	1/box	186001831
Extraction Plate Manifold Kit A (includes extraction plate manifold, reservoir tray, sealing cap and 350 μL sample collection plate)	—	WAT097944
Extraction Plate Manifold Kit B (as Kit A, with 1 mL sample collection plate)	—	WAT097945
Extraction Plate Manifold Kit C (as Kit A, with 2 mL sample collection plate)	—	WAT097946
Disposable Reservoir Tray	25/box	WAT058942
Sample Collection Plate, 350 μL	50/box	WAT058943
Sample Collection Plate, 2 mL	50/box	WAT058958
Sealing Cap for 96-well Collection Plate	50/pk	WAT058959
Vacuum Pump (115 V 60 Hz)	—	725000417
Vacuum Pump (240 V 50 Hz)	—	725000604
Vacuum Box Gasket Kit (Kit includes: 2 foam top gaskets, 2 orange O-rings)	—	186003522

Manifold and Accessories for Extraction Cartridges

Description	Qty.	Part No.
Waters Extraction Manifold, 20-position without rack (includes 20 needle tips, 25 plugs, and ejector tool)	—	WAT200677
Waters Extraction Manifold, 20-position (complete with rack for 13 x 75 mm tubes)	—	WAT200606
Waters Extraction Manifold, 20-position (complete with rack for 13 x 100 mm tubes)	—	WAT200607
Waters Extraction Manifold, 20-position (complete with rack for 16 x 75 mm tubes)	—	WAT200608
Waters Extraction Manifold, 20-position (complete with rack for 16 x 100 mm tubes)	—	WAT200609
30 cc Reservoir	48/pk	WAT011390
60 cc Reservoir	12/pk	186005587
Reservoir Adapters for 1, 3 and 6 cc Cartridges	12/pk	WAT054260
Reservoir Adapters for 12, 20 and 35 cc Cartridges	10/pk	WAT048160
Male-Male Adapter	100/pk	WAT024310
Male Luer Plugs	100/pk	WAT044395
Female Luer Plugs	100/pk	WAT044385

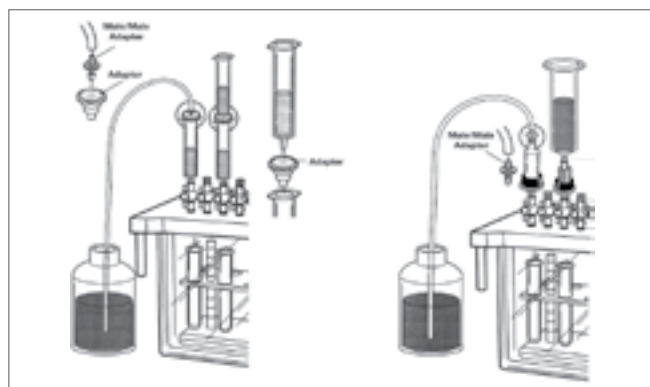
Sep-Pak Cartridge Connections Kit



Sep-Pak Cartridge Connections Kit

Description	Part No.
Sep-Pak Connections Kit	WAT011400

Sep-Pak Cartridge Accessories



Accessories for Extraction Columns and Cartridges

Description	Qty.	Part No.
Holder Kit for 2.1 x 20 mm Cartridge Column	1/pk	186000262
Holder Kit for 3.9 x 20 mm Cartridge Column	1/pk	WAT046910
Extraction Column Connector	1/pk	WAT082745
In-line Pre-column Filter Kit	1/pk	WAT084560
Replacement Filters	5/pk	WAT005139
Vacuum Pump (115 V 60 Hz)	—	725000417
Vacuum Pump (240 V 50 Hz)	—	725000604
Reservoir, 30 cc (for Plus, Light, and Vac Cartridges)	48/pk	WAT011390
Reservoir, 60 cc (for Plus, Light, and Vac Cartridges)	12/pk	186005587
Adapter, Male-male Luer (for Classic Cartridges)	100/pk	WAT024310
Adapter (to attach reservoir to 1, 3 and 6 cc Vac Cartridges)	12/pk	WAT054260
Adapter (to attach reservoir to 12, 20 and 35 cc Vac Cartridges)	10/pk	WAT048160
2 mL Vial Rack for Manifold	—	186005234

Waters Positive Pressure-96 Processor

The Waters Positive Pressure-96 Processor offers state-of-the-art operation for 96-well plates and 1 cc flangeless cartridge formats. Each of the 96 holes in the processor is restricted in order to maintain constant pressure, even if all the plate well positions are not filled. Positive pressure processing offers many advantages over traditional methods, including:

- Highly uniform flow from well to well
- Superior flow for viscous samples
- Highly reproducible assays
- Easy-to-use design



Waters Positive Pressure-96 Processor

Description	Qty.	Part No.
Waters Positive Pressure-96 Processor	1	186006961
96-flangeless Cartridge Holder	1	186005523
96-place Sealing Gasket	1	186005522
μElution Positive Pressure Spacer	1	405006528
Gas Supply Adapter, includes 1/8 in to 1/4 in NPT fitting, 6 feet of 1/4 in tubing	1	186005524
10 mL x 24 Waste Collection Plate	1	186005586

OSTRO PASS-THROUGH SAMPLE PREPARATION PRODUCT



The Simplest Way to Cleaner Samples

Ostro™ Pass-through 96-well Plate provides a novel solution for cleanup, requiring minimal to no method development, using a combination of filtration and sorbent interactions to produce cleaner samples in less time.

- Pass-through sample preparation technique
- Removes significantly more phospholipids, and proteins
- For reproducible, consistent and robust methods
- Increases throughput with easy-to-implement protocol
- Simple generic protocols
- Widely used in bioanalysis, food, and environmental application

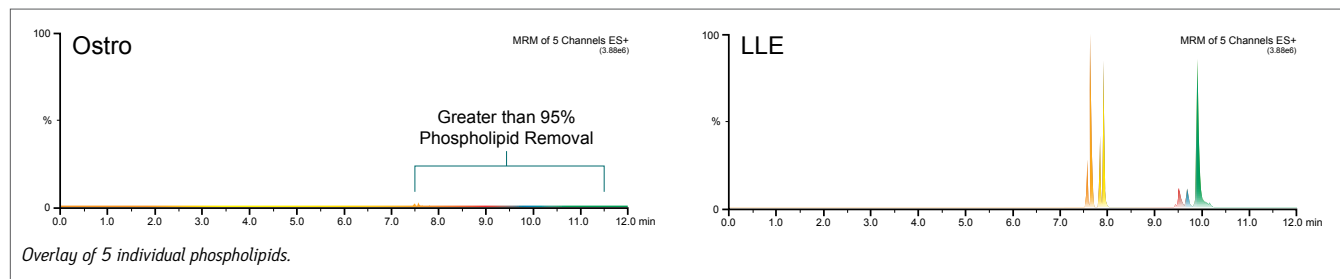
Ostro Pass-Through Sample Preparation Plate

Description	Qty.	Part No.
Ostro Pass-through Sample Preparation 96-well Plate (25 mg)	1	186005518

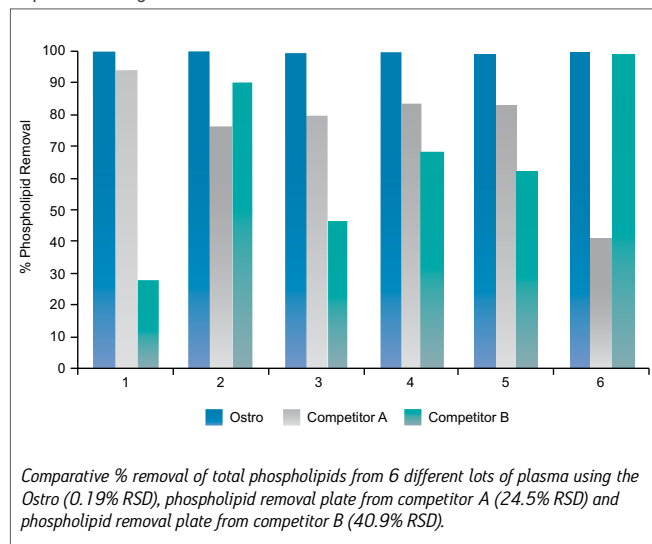
Phospholipid Removal

Ostro Plates remove more than 95% of phospholipids and are 15 times faster than traditional liquid-liquid extractions (LLE).

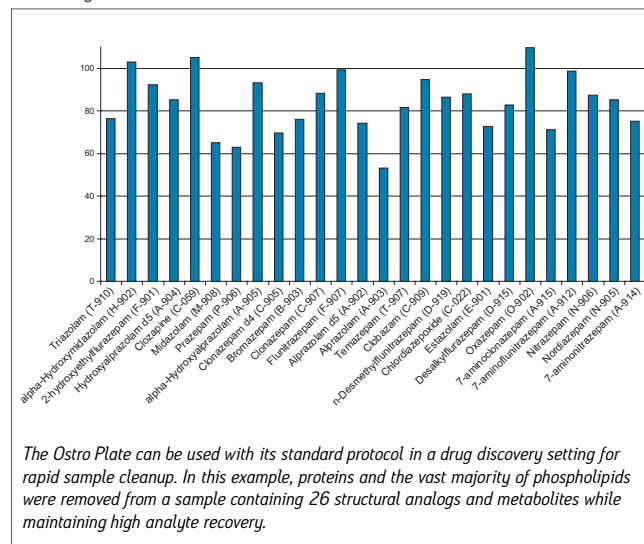
Ostro and SLE



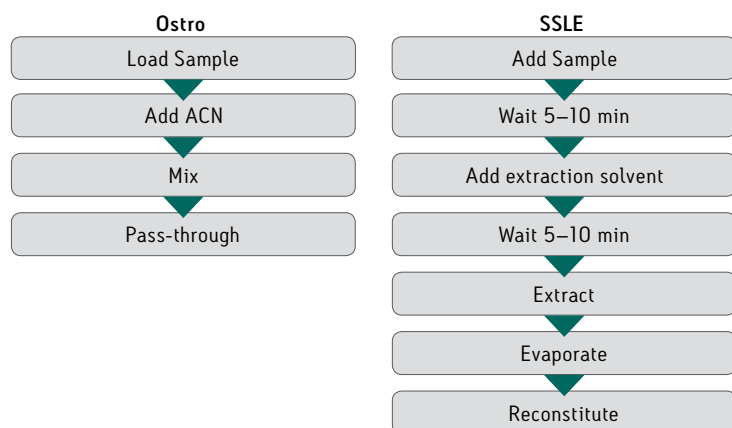
Reproducibility



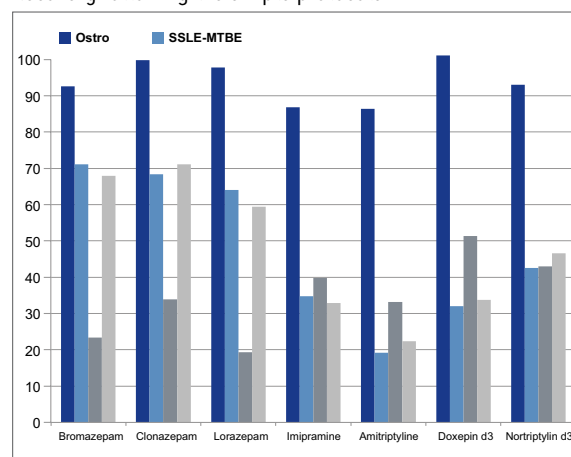
Recovery



Protocol comparison



Recovery following the simple protocols



Key Advantages of Ostro Pass Through Technique in Comparison to SSLE

	Recovery	Phospholipids Removal	Ease of Use	Environment Impact	Analysis Time	Method Development	Generic
Ostro	✓	✓	✓	✓	✓	No	✓
SSLE	✓	✓				Yes	



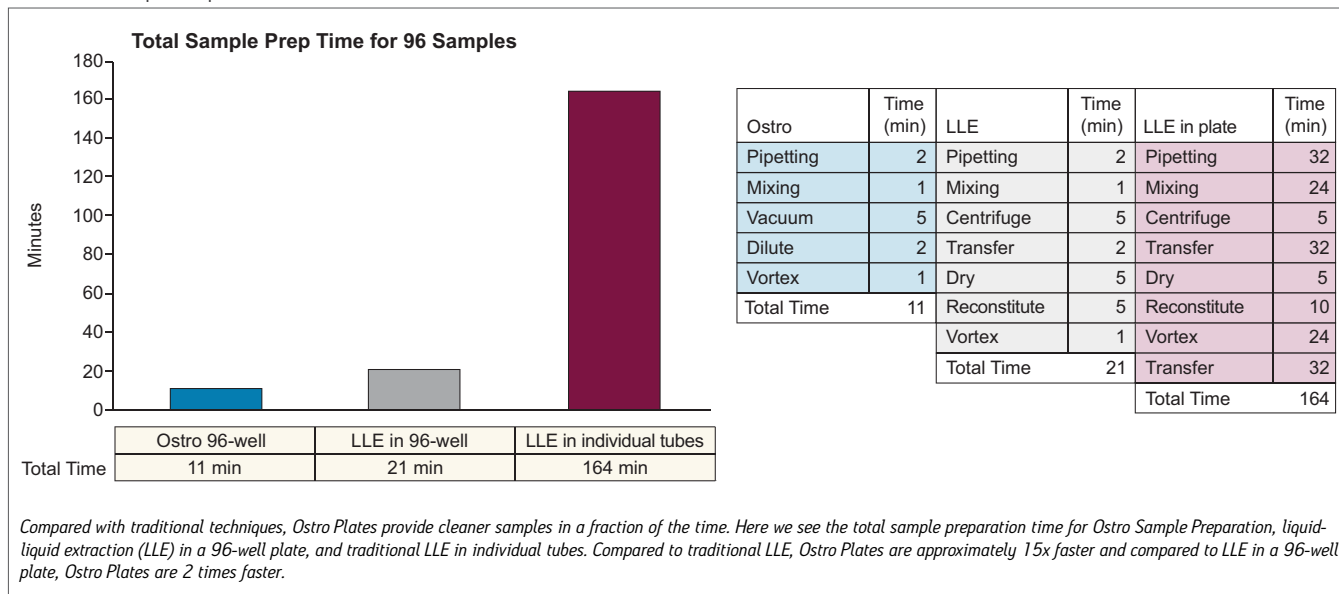
Ordering online has never been easier or more secure!

Go to www.waters.com/order and you can:

- ✓ Check out our latest discounts for online shopping.
- ✓ Find out pricing and product availability quickly and easily.
- ✓ Set up wish lists for important, upcoming projects.
- ✓ eMail your cart or wish list to other project or purchasing colleagues.

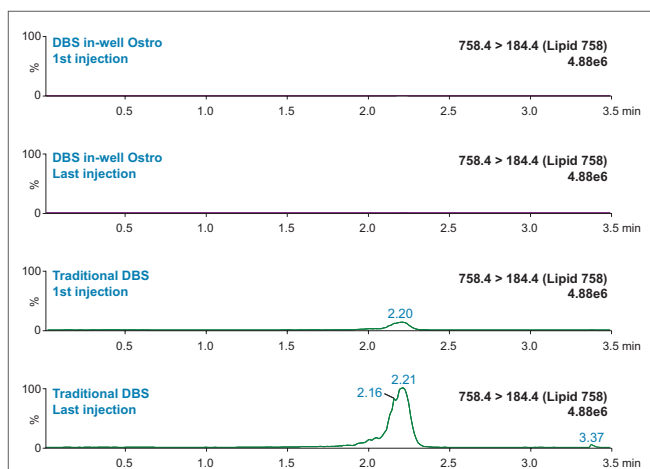


Decreased Sample Preparation Time



Increased Instrument Uptime

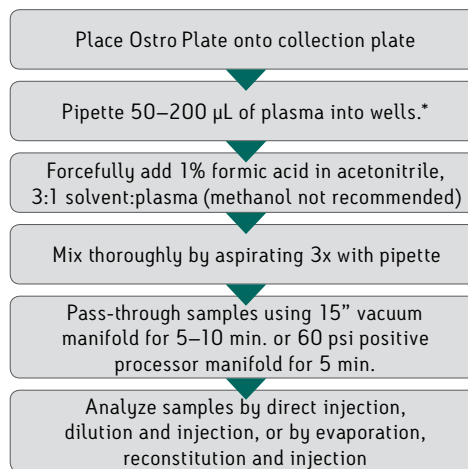
Phospholipids can build up on your LC column and MS system. This leads to unpredictable, inaccurate results and necessitates extensive system cleaning and instrument downtime. Removing these contaminants before they enter your system provides increased instrument robustness, improved results, and maximum laboratory efficiency. In the example below, the Ostro Plate is used in conjunction with Dried Blood Spot (DBS) analysis to prevent phospholipid build up in an MS instrument. The chromatograms below show DBS without any cleanup using Ostro (note the build up of phospholipids over the course of 250 injections).



Chromatograms of the MRM transition 758 > 184.4 to demonstrate build-up of an individual PL over subsequent injections using traditional DBS and DBS extracted in-well using the Ostro Plate. A gradient from 25–99.5% B in 2 minutes was used followed by a 1 minute hold at high organic.

Protocol

Minimizing method development time, the standard Ostro protocol will provide excellent results for a wide variety of acidic, basic, and neutral compounds.



* For sample volumes 50 µL or less, a higher solvent to plasma ratio may be necessary.

DISQUE SAMPLE PREPARATION SOLUTIONS FOR QUECHERS

QuEChERS (an acronym for Quick, Easy, Cheap, Effective, Rugged, and Safe) methods offer a simple and straightforward sample preparation technique ideal for multi-residue analysis for pesticides, veterinary drugs, and mycotoxins in a wide variety of food and agricultural products. DisQuE™ Dispersive Sample Preparation Products are conveniently packaged with pre-weighed sorbents and buffers in pouches and tubes as described in regulatory methods and protocols. These products offer several advantages over traditional sample preparation techniques:

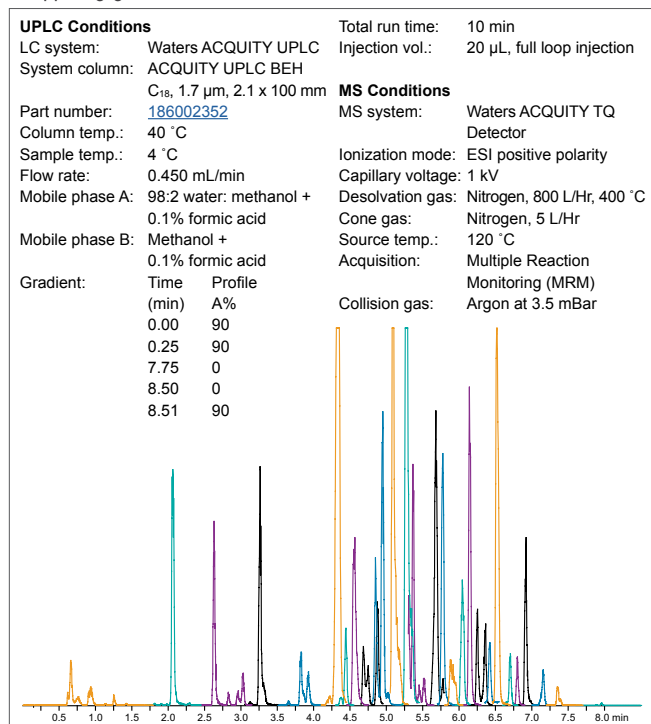
- Simplified QuEChERS protocols
- Decreased sample preparation time
- Efficient and cost effective sample preparation
- Consistent, high quality sorbents, and packaging

DisQuE Kitted Solutions

Complete solutions and kitted methods add value to your laboratory function by addressing the need for simple, easy-to-follow protocols that require very little training.

Waters offers several different versions of pre-packaged QuEChERS kits which conform to both AOAC and CEN protocols.





Chromatogram Showing 402 Pesticide Residues at 10 ppb ng/g In One 10 Minute Run



DisQuE™ Dispersive Sample Preparation













DisQuE Dispersive Sample Preparation Products

Description	Part No.
DisQuE Kits	
DisQuE Dispersive SPE Kit–Pouch Format	176002922
<ul style="list-style-type: none"> ■ Pouch: 1.5 g sodium acetate and 6 g MgSO₄ ■ 50 mL Tube: Empty ■ 2 mL Tube: 150 mg MgSO₄ and 50 mg PSA 	
	
DisQuE Dispersive SPE Kit–Pouch Format	176002923
<ul style="list-style-type: none"> ■ Pouch: 1 g trisodium citrate dihydrate, 0.5 g disodium hydrogencitrate sesquihydrate, 1 NaCl and 4 g MgSO₄ ■ 50 mL Tube: Empty ■ 2 mL Tube: 150 mg MgSO₄, 25 mg PSA, and 25 mg C₁₈ 	
	
DisQuE AOAC Dispersive SPE Kit	176001676
<ul style="list-style-type: none"> ■ Tube 1: 50 mL tube containing: 1.5 g Sodium Acetate and 6 g MgSO₄ ■ Tube 2: 2 mL tube containing: 150 mg MgSO₄ and 50 mg PSA 	
	
DisQuE CEN Dispersive SPE Kit	176001903
<ul style="list-style-type: none"> ■ Tube 1: 50 mL tube containing: 1 g Trisodium Citrate Dihydrate, 0.5 g Disodium Hydrogencitrate Sesquihydrate, 1 g NaCl and 4 g MgSO₄ ■ Tube 2: 2 mL Tube containing: 150 mg MgSO₄, 25 mg PSA, and 25 mg C₁₈ 	
	

DisQuE Extraction and Clean-up Tubes and Pouches

DisQuE Extraction and Clean-up Tubes and Pouches are available separately for customized applications and method development. The salts contained in the 50 mL tubes are also available in a pouch format for greater flexibility. The clean-up tubes are available in a standard 2 mL size as well as a 15 mL size for sample enrichment.

DisQuE Dispersive Sample Preparation Products	
Description	Part No.
Individual Extraction Tubes (Tube 1)	
50 mL Empty Tube for QuEChERS Extraction	50/pk 186006814
	
DisQuE 50 mL Tube/AOAC-Acetate	DisQuE 50 mL tube containing: 1.5 g Sodium Acetate and 6 g MgSO ₄ 100/pk 186004571
	
DisQuE 50 mL Tube/CEN-Citrate	DisQuE 50 mL tube containing: 1 g Trisodium Citrate Dihydrate, 0.5 g Disodium Hydrogenecitrate Sesquihydrate, 1 g NaCl and 4 g MgSO ₄ 100/pk 186004837
	
Individual Extraction Tubes (Tube 1)	
DisQuE Pouch	1.5 g sodium acetate, 6 g MgSO ₄ 50/pk 186006812
	
	4 g MgSO ₄ , 1 g NaCl, 1 g trisodium citrate dehydrate, 0.5 g disodium hydrogenecitrate sesquihydrate 50/pk 186006813

Description	Part No.
Clean-up Tubes (Tube 2)	
DisQuE 2 mL Tube-AOAC White Cap	DisQuE 2 mL tube containing: 150 mg MgSO ₄ and 50 mg PSA* 100/pk 186004572
	
DisQuE 2 mL Tube-AOAC with C ₁₈ Blue Cap	DisQuE 2 mL tube containing: 150 mg MgSO ₄ , 50 mg PSA*, and 50 mg C ₁₈ 100/pk 186004830
	
DisQuE 2 mL Tube-CEN Yellow Cap	DisQuE 2 mL tube containing: 150 mg MgSO ₄ and 25 mg PSA* 100/pk 186004831
	
DisQuE 2 mL Tube-CEN with C ₁₈ Green Cap	DisQuE 2 mL tube containing: 150 mg MgSO ₄ , 25 mg PSA*, and 25 mg C ₁₈ 100/pk 186004832
	
DisQuE 15 mL Tube/MgSO ₄ /PSA Blue Cap	DisQuE 15 mL tube containing: 900 mg MgSO ₄ and 150 mg PSA* 50/pk 186004833
	
DisQuE 15 mL Tube/MgSO ₄ /PSA/C ₁₈ White Cap	DisQuE 15 mL tube containing: 900 mg MgSO ₄ , 150 mg PSA*, and 150 mg C ₁₈ 50/pk 186004834
	

*PSA: Primary-Secondary Amine silica bonded sorbent

Bulk Sorbents

Graphitized Carbon Black (GCB) Sorbent

Some fruits and vegetables, such as spinach, red sweet pepper, and carrots, have high content of non-polar pigments, such as carotenoids or chlorophyll. QuEChERS effectively removes some common matrix constituents, such as fatty acids and sugars; however, samples that contain high levels of pigment require additional treatment. Graphitized carbon black (GCB) effectively removes these pigments, and can be added to the clean-up tube with PSA and MgSO₄ during the d-SPE cleanup step. The clean-up of pigments is especially critical for gas chromatographs because pigments often accumulate in the injection port, quickly fouling the injection liner.



Description	Part No.
Bulk Sorbents	
Graphitized Carbon Black, 25 g Bottle	186004835
C ₁₈ , 100 g Bottle	WAT035672

PORAPAK RXN CARTRIDGES FOR POST-SYNTHESIS CLEANUP

PoraPak Rxn, a family of polymer-based chromatography products for superior cleanup of synthetic reactions. PoraPak Rxn Products are available in two chemistries:

- PoraPak Rxn CX, a strong cation-exchange sorbent
- PoraPak Rxn RP, a reversed-phase sorbent

PoraPak Rxn Sorbents are available in fritted syringe-barrel devices in 6, 20, and 60 cc volumes. The resins are also sold in bulk units, and custom configurations are available on request.

New Solutions for Faster Results

PoraPak Rxn Sorbents are based on copolymers that exhibit the following properties:

- Hard material that does not develop increasing back pressure with flow
- Little swelling or shrinking across a range of solvents and pH extremes
- Low hydraulic resistance enables flow by gravity
- pH extreme tolerance without dissolution or hydrolysis, both limitations of silica-based sorbents

This combination of physical and chemical properties makes PoraPak Rxn Cartridges ideal for synthesis cleanup. The polymers characteristics and particle size maintain gravity-, pressure-, or vacuum-assisted flow; even when reaction mixtures contain precipitate that may contribute additional resistance to flow. The sample will still pass through the cartridge.

The polymer used in PoraPak Rxn Products is resistant to shrinking or swelling in the organic solvents typically used in synthetic reactions. Tests with the following solvents demonstrate that the packed bed maintains good flow properties:

- DCE
- THF
- DMF
- DMSO
- DCM
- Acetone

Some medicinal chemists are familiar with silica-based chromatographic products for reaction cleanup. One of the limitations of these silica-based ion-exchange materials is pH. Silica will dissolve at high pH, while bonded phases are hydrolyzed at low pH; both conditions result in loss of sample and/or impurities (silica and bonded phase) collected in product fractions. PoraPak Rxn polymer-based chromatographic phases are stable at extreme pH. This feature permits using pH as a very powerful tool to create a separation, particularly in ion-exchange mode.

PoraPak™
Rxn
Post Synthesis Cleanup



Providing Separations Solutions

Waters is highly respected worldwide for its expertise in chromatography. Coupled with our ability to seamlessly link critical instrumentation, chemistries, separation technologies, and software, this expertise puts us in a unique position to deliver value-added solutions to our customers.

Manufacturing

Our world-class manufacturing facilities are continuously expanded and upgraded to keep pace with market demand for our new and existing products. We manufacture under the highest quality standards in the industry, including ISO 9001, ISO 13485, and Current Good Manufacturing Practices (cGMP).

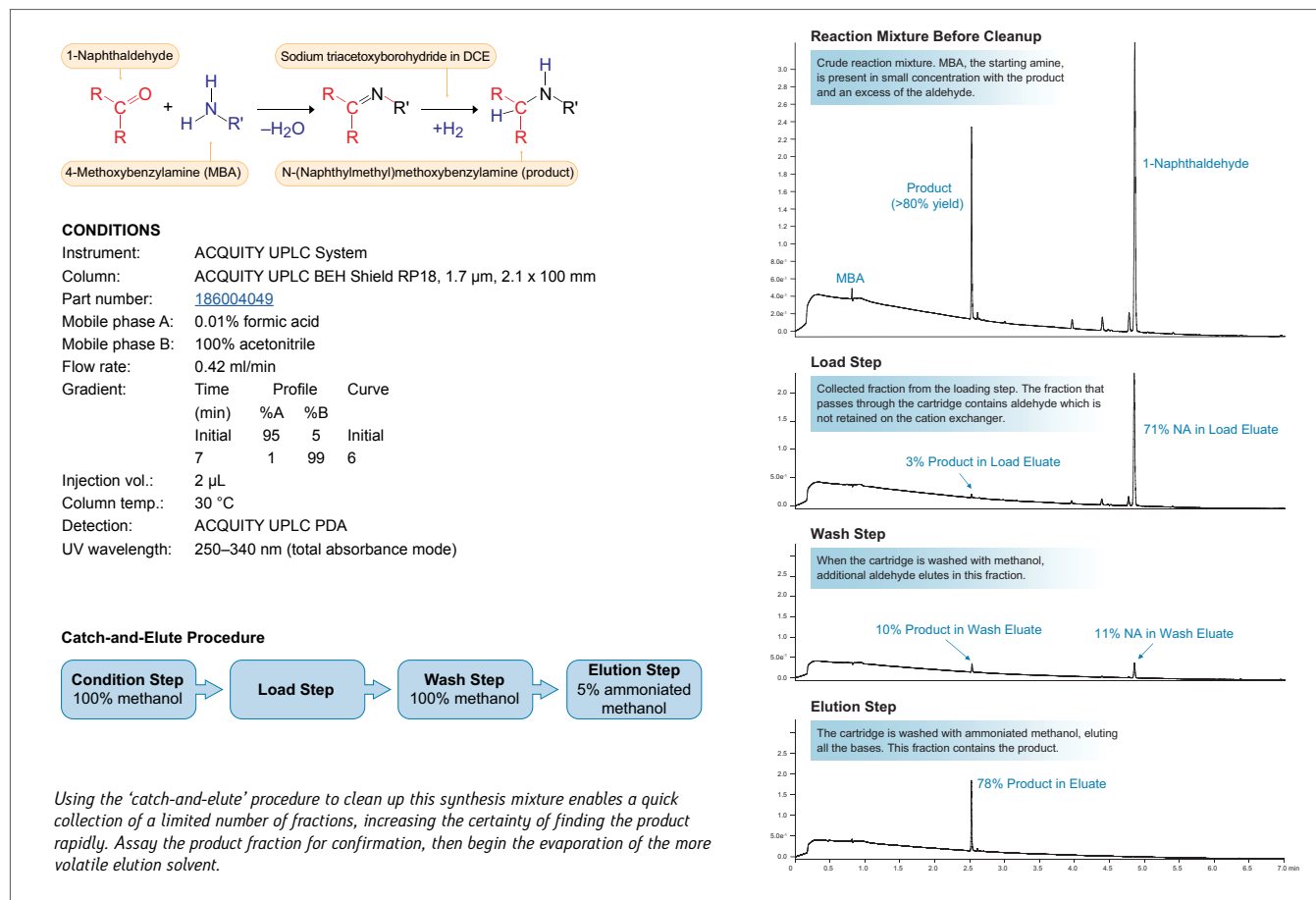
PoraPak Rxn Cartridges and Bulk Material

Description	PoraPak Rxn CX	PoraPak Rxn RP
6 cc Flanged Cartridges, 400 mg, 30/pk	186004541	186004545
6 cc Flangeless Cartridges, 400 mg, 30/pk	186004542	186004546
20 cc Cartridges, 2 g, 20/pk	186004543	186004547
60 cc Cartridges, 5 g, 10/pk	186004544	186004548
Bulk, 200 mL/Container	186004569	186004570



Cleanup of a Reductive Amination Mixture

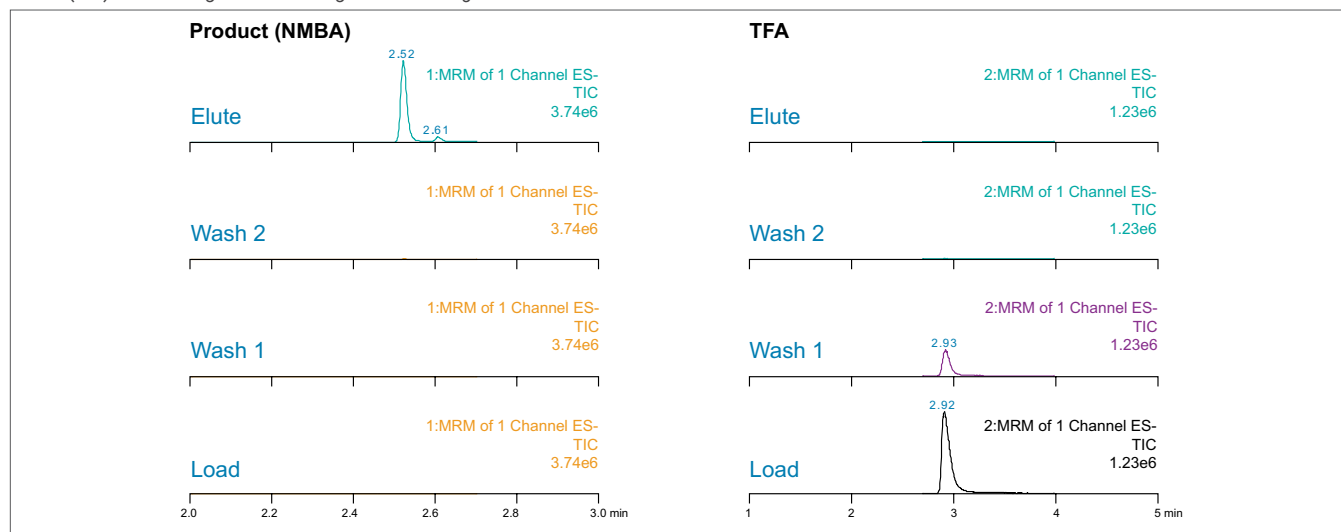
Reductive amination is a common reaction carried out in medicinal chemistry laboratories. In this example, a PoraPak Rxn CX Cartridge is used to fractionate the reaction mixture.



Removal of TFA from Reversed-Phase Prep-LC Fractions; Isolation of the Purified Free-Base Product

Removal of TFA from prep-LC product fraction is important as residual TFA has been linked to compound degradation. This simple protocol removes TFA and water from product fraction for rapid evaporation. After evaporation the compound is in free-base form.

LC-MS(MS) Chromatograms Showing Product Only in the Elute Fraction and all TFA in the Load and Wash Fractions



Product Guidelines

The following tables should be used as guidelines for loading capacity, flow rates, and volumes of wash and elution solvents. These tables take into consideration the dimension of the device and the bed volumes suggest appropriate flow rates and volumes for the condition, wash, and elute steps.

Maximum Capacity Guidelines	PoraPak Rxn RP	PoraPak Rxn CX
Configuration	Retained Compounds	Retained Base
6 cc/150 mg	15 mg/50 μ mole	15 mg/50 μ mole
6 cc/400 mg	40 mg/150 μ mole	40 mg/150 μ mole
20 cc/2 g	200 mg/350 μ mole	200 mg/350 μ mole
60 cc/5 g	500 mg/2000 μ mole	500 mg/2000 μ mole

The capacity is for the total of all compounds in the reaction that will be retained. For cation exchange, the capacity is for all bases in the reaction mixture including product and reactants.

Consider smaller loads than maximum capacity guidelines or choose a larger device to avoid compound break through.

Flow Rate Guidelines	
Cartridge	Flow Rate
6 cc cartridge	2 mL/min
20 cc cartridge	5 mL/min
60 cc cartridge	9 mL/min

Flow rate guideline is meant to provide a flow for reaction loading step.

The reaction mix can be poured into the cartridge and allowed to flow by gravity. If the flow is too slow, simply add a small amount of pressure or vacuum to increase it. If there is precipitate in the reaction vessel, rinse the vessel with more loading solvent and add to the top of the cartridge. During the washing steps, product trapped by the precipitate may be dissolved and can be retained on the packed bed for later elution under the right solvent conditions.

Wash and Elution Volumes			
Device	Condition	Wash	Elute
6 cc/150 mg	3 mL	4 mL	4 mL
6 cc/400 mg	5 mL	10 mL	10 mL
20 cc/2 g	20 mL	20 mL	20 mL
60 cc/5 g	45 mL	45 mL	45 mL

This table provides guidelines for volumes used in the condition, wash and elution steps for the various sizes of PoraPak Rxn Cartridges.



Did you know...

Product care and use information is available on our website!

Go to: www.waters.com, under "Services and Support" look for "User Guides" or go to www.waters.com/chemcu



WATERS/PALL LIFE SCIENCES SAMPLE AND SOLVENT FILTRATION PRODUCTS



Filtration of samples and solvents is a preventative maintenance procedure that saves lab time and money. Filtration provides immediate protection for the components of column and instrumentation by minimizing down time.

Waters/Pall Life Sciences Filters have been Certified for Compliance; which means they have been designed and developed to assist customers in complying with their regulatory and quality objectives.

Waters carries a broad range of Pall Life Sciences Filter Products, a range of different membranes for solvent and sample compatibility, and a variety of devices for various filtration applications.

Choosing the Right Filter for your Application.

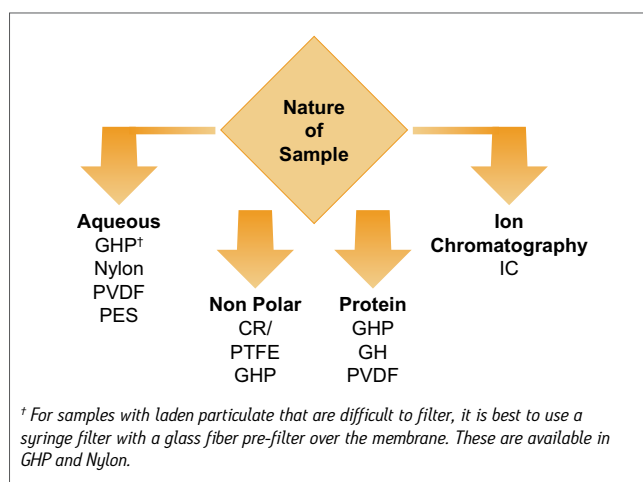
To choose the right filter you need to consider sample characteristics, volume, pore size, and decide if the sample may require prefiltration because it is laden with particulate matter.

Membrane Choices

- GHP Acrodiscs**
 Hydrophilic propylene membrane suitable for aqueous, organic and has low protein binding
- Nylon Acrodiscs**
 Hydrophilic nylon membrane
- GHP Acrodiscs GF and Nylon Acrodiscs GF**
 Designed with a glass fiber prefilter over the membrane for hard to filter samples laden with particulate matter
- Glass Fiber Acrodiscs**
 Can be used alone or as a prefilter with another Acrodiscs in series
- Acrodisc LC (PVDF)**
 Hydrophilic polyvinylidene fluoride good for aqueous and organic solvents
- Acrodisc CR (PTFE)**
 Used for aggressive organic solvents
- Ion Chromatography (IC) Acrodisc**
 Certified to contain low ionic backgrounds
- Supor (PES)**
 Hydrophilic polyethersulfone for biological, pharmaceutical or sterilizing. Can be gamma sterilized or autoclaved

Concerned about particulate matter in your sample?

Step 1: What is the nature of your sample?



Step 2: What micron size are the particles in the column you are using?

Column	Pore Size of Filter
> 3 µm	0.45 µm
< 3 µm	0.20 µm

Step 3: What is the volume of your sample?

Volume	Acrodisc Size	Hold Up Volume
< 2 mL	4 mm	< 10 µL
< 10 mL	13 mm minispikes	< 14 µL
< 10 mL	13 mm male luer	< 30 µL
< 100 mL	25 mm	< 100 µL

Example 1: 1.5 mL of aqueous sample to be filtered for injection on a 5 µm column:

Step	Question	Answer	Choice
1	Sample	Aqueous	GHP and others
2	Particle size in column	5 µm	0.45 µm
3	Volume	1.5 mL	4 mm or larger

Choice: Membrane 0.45 µm GHP Acrodisc® in 4 mm or larger. You can also use the Nylon, PVDF or PES (other choices of hydrophilic membranes under the aqueous sample path). In terms of device size, if you are injecting only a few µL of sample on the column, you can use any device size. The 13 and 25 mm Acrodiscs® have hold up volumes of at most 100 µL, leaving plenty of filtered sample for the application.

Filter Design and Membrane Choices

	Acetone	Acetonitrile	Acetic acid, glacial	n-Butanol	Chloroform	Dioxane	Dimethyl formamide	Dimethyl sulfoxide	Ethanol	Ethyl acetate	Ethyl ether	Freon TF	Hydrochloric acid (1N)	Hexane, dry	Methanol	Methylene chloride	Methyl ethyl ketone	N-Methylpyrrolidone	Isopropanol	Sodium hydroxide (5N)	Tetrahydrofuran	Tetrahydrofuran/water (50/50)	Toluene	Water	
GH Polypro Syringe Filters																									
GHP Acrodisc 13 (13 mm)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
GHP Acrodisc (25 mm)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
GHP Acrodisc GF (25 mm)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
PTFE Syringe Filters																									
Acrodisc 4CR PTFE (4 mm)	R*	R	R	R	LR	R	R*	R*	R	R*	R	R	R	R	R	LR	R*	R*	R	LR	LR	•	LR*	R	
Acrodisc 13CR PTFE (13 mm)	R*	R	R	R	R	R	R*	R*	R	R*	R	R	R	R	R	R	R*	R*	R	R	R	R	R*	R	
Acrodisc CR PTFE (25 mm)	R*	R	R	R	R	R	R*	R*	R	R*	R	R	R	R	R	R	R*	R*	R	R	R	R	R*	R	
PVDF Syringe Filters																									
Acrodisc LC13 PVDF (13 mm)	NR*	R	R	R	R	R	NR*	NR*	R	R*	R	R	R	R	R	R	NR*	NR*	R	NR	R	R	R*	R	
Acrodisc LC PVDF (25 mm)	NR*	R	R	R	R	R	NR*	NR*	R	R*	R	R	R	R	R	R	NR*	NR*	R	NR	R	R	R*	R	
Nylon Syringe Filters																									
Nylon Acrodisc 4 (4 mm)	R*	R	R	R	NR	•	R*	R*	R	R*	NR	R	NR	R	R	NR	R*	R*	R	R	NR	LR	R*	R	
Nylon Acrodisc 13 (13 mm)	R*	R	R	R	NR	•	R*	R*	R	R*	NR	R	NR	R	R	NR	R*	R*	R	R	NR	LR	R*	R	
Nylon Acrodisc (25 mm)	R*	R	R	R	NR	•	R*	R*	R	R*	NR	R	NR	R	R	NR	R*	R*	R	R	NR	LR	R*	R	
Nylon Acrodisc GF (25 mm)	R*	R	R	R	NR	•	R*	R*	R	R*	NR	R	NR	R	R	NR	R*	R*	R	R	NR	LR	R*	R	
Ion Chromatography Syringe Filters																									
IC Acrodisc (13 mm & 25 mm)	NR	LR	NR	R	NR	•	NR	NR	•	LR	R	LR	•	LR	R	NR	•	NR	•	•	NR	•	R	R	
Glass Fibre Syringe Filters																									
GF Acrodisc	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	NR	R	R	R	
Acrylic Copolymer Syringe Filters																									
Non-sterile Acrodisc (25 mm)	NR	NR	NR	R	NR	NR	NR	NR	R	NR	NR	R	LR	NR	R	NR	NR	NR	R	R	NR	NR	NR	R	
Disc Filters																									
GH Polypro	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
FP Verciel (PVDF)	NR	R	R	R	R	LR	NR	NR	R	R	R	R	R	R	R	R	LR	NR	R	NR	LR	•	R	R	
Nylaflo (Nylon)	R	R	NR	R	NR	R	R	R	R	R	R	R	NR	•	LR	NR	NR	R	R	R	R	R	NR	R	
TF (PTFE)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	

Note:

R = Resistant

No significant change was observed in flow rate or bubble point of the membrane.

* UV absorbance was set at 254 nm

LR = Limited Resistance

Moderate changes in physical properties or dimension of the membrane were observed.

The filter may be suitable for short term, non-critical use at room temperature.

NR = Not Resistant

The membrane is basically unstable. In most cases, extensive shrinkage or swelling occurs.

The filter may gradually weaken or partially dissolve after extended exposure.

• = Insufficient Data

4 mm Polypropylene Housing Male Luer

13 mm Polypropylene Housing Male Luer



13 mm Polypropylene Housing Minispike

25 mm Polypropylene Housing Male Luer

Syringe Filters					
Acrodisc 13 mm					
		0.2 μm		0.45 μm	
	Pack Size	100	1000	100	1000
Aqueous	NYLON	WAT200524	WAT200834	WAT200520	WAT200832
	PVDF	WAT200806	—	WAT200512	WAT200827
Non Polar	CR	WAT200506	WAT200823	WAT200502	WAT200821
Protein	PVDF	WAT200806	—	WAT200512	WAT200827
Ion Chromatography	IC	WAT200810	WAT200844	WAT200812	WAT200842
Acrodisc 13 mm Minispike					
		0.2 μm		0.45 μm	
	Pack Size	100	1000	100	1000
Aqueous	GHP	WAT097962	186005595	WAT200516	WAT200830
	NYLON	WAT200562	WAT200835	WAT200564	WAT200836
	PVDF	WAT200804	WAT200838	WAT200560	WAT200828
Non Polar	CR	WAT200556	WAT200824	WAT200558	WAT200825
	GHP	WAT097962	186005595	WAT200516	WAT200830
Protein	PVDF	WAT200804	WAT200838	WAT200560	WAT200828
Acrodisc 25 mm					
		0.2 μm		0.45 μm	
	Pack Size	50	1000	50	1000
Aqueous	GHP	WAT097964	186005596	WAT200514	WAT200829
	NYLON	WAT200522	WAT200833	WAT200518	WAT200831
	PVDF	WAT200808	WAT200839	WAT200510	WAT200826
	GHP GF	—	—	WAT200802	WAT058853
	NYLON GF	—	—	WAT200800	WAT200846
	GF	—	—	WAT200818	WAT200840
	Versapor	—	—	—	WAT200841
	Sterile Syringe PES	WAT200529	—	—	—
Non Polar	CR	WAT200504	WAT200822	WAT200500	WAT200820
	GHP	WAT097964	186005596	WAT200514	WAT200829
Protein	PVDF	WAT200808	WAT200839	WAT200510	WAT200826
Ion Chromatography	IC	WAT200814	—	WAT200816	WAT200843

Waters Filter Selector

The Waters Filter Selector helps you select the most appropriate filter for your analysis. Simply answer 3 easy questions about particle size, sample volume, and sample type and we will identify the most suitable filter.

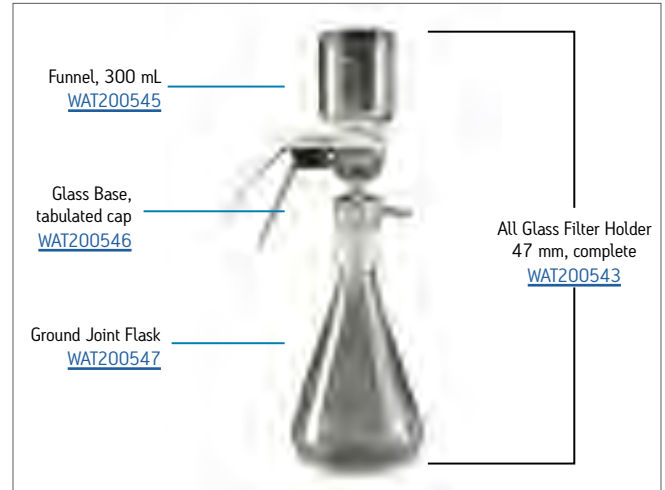
For more information about Waters Filter Selector, please visit: www.waters.com/filterselector



Solvent Filtration Apparatus

The 300 mL capacity 47 mm Glass Filter Funnel and 1 L capacity 47 mm Glass Funnel/Support Assembly are ideal for vacuum filtration of liquids and degassing of HPLC solvent and mobile phases. The 100% borosilicate glass construction assures resistance to even the most aggressive solvents.

Description	Part No.
Solvent Filtration Apparatus 110 V, 60 Hz	176002986
Solvent Filtration Apparatus 220 V, 50 Hz	176002987
All Glass Filter Holder 47 mm, complete	WAT200543
Funnel, 300 mL	WAT200545
Glass Base, tabulated cap	WAT200546
Ground Joint Flask	WAT200547
Swinney Holder	WAT200566
Vacuum Pump 110 V, 60 Hz	725000417
Vacuum Pump 220 V, 50 Hz	725000604



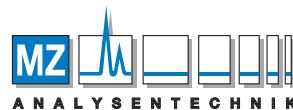
Solvent Filtration Membranes

Description	Diameter	Pore Size	Qty.	Part No.
PVDF Filter	47 mm	0.45 µm	100/pk	WAT200530
Nylon Filter	47 mm	0.45 µm	100/pk	WAT200532
PTFE Filter	47 mm	0.45 µm	100/pk	WAT200534
	13 mm	0.45 µm	100/pk	WAT200536
GH Polypro Filter	47 mm	0.45 µm	100/pk	WAT200537
	47 mm	0.45 µm	100/pk	WAT200538
Supor (PES) Filter	47 mm	0.45 µm	100/pk	WAT200540
	13 mm	0.45 µm	100/pk	WAT200540
PVDF Filter	47 mm	0.2 µm	100/pk	WAT200531
Nylon Filter	47 mm	0.2 µm	100/pk	WAT200533
PTFE Filter	47 mm	0.2 µm	100/pk	WAT200535
GHP	47 mm	0.2 µm	100/pk	186003524
Supor (PES) Filter	47 mm	0.2 µm	100/pk	WAT200539
Thick Glass Filter	10 mm	1.0 µm	100/pk	WAT200541

Did you know...

Product care and use information is available on our website!

Go to: www.waters.com, under "Services and Support" look for "User Guides" or go to www.waters.com/chemcu



AUTHORIZED DISTRIBUTOR

MZ-Analysentechnik GmbH
 Barcelona-Allee 17 • D-55129 Mainz
 Tel +49 6131 880 96-0
 Fax +49 6131 880 96-20
 e-mail: info@mz-at.de
www.mz-at.de