



**MERCK**

# Pesticide Analysis— Complete Workflow Solutions

**Reliable Products for  
Comprehensive Analyses**

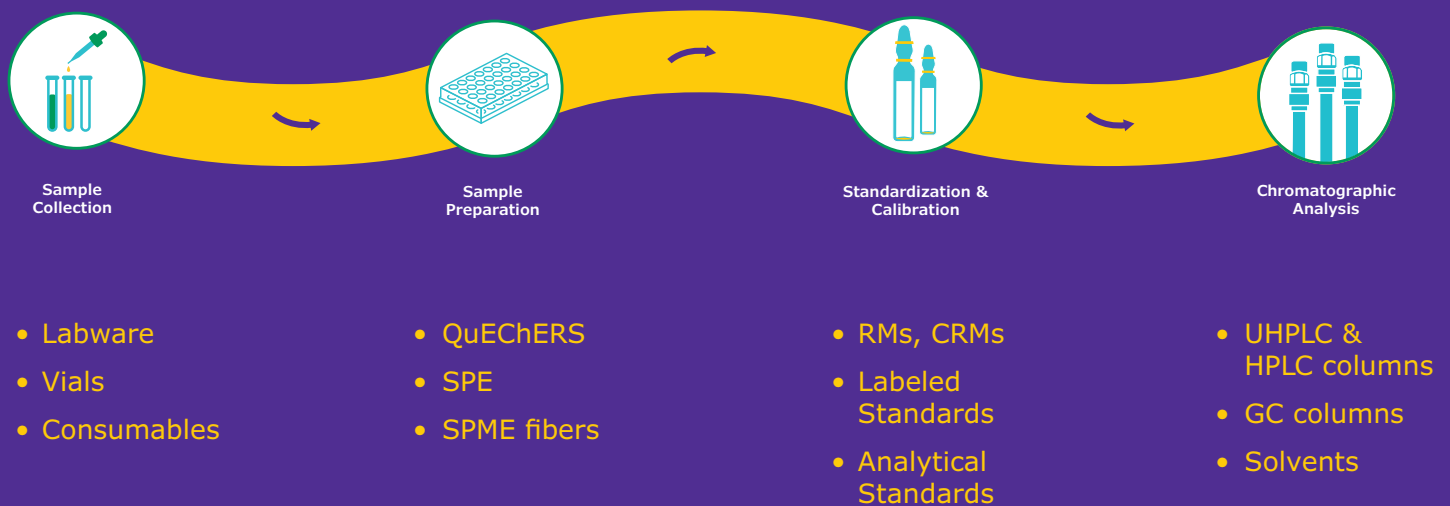
**Supelco.**  
Analytical Products

**Millipore®**  
Preparation,  
Separation, Filtration  
& Monitoring Products

**Sigma-Aldrich®**  
Lab & Production Materials

The Life Science business of Merck operates  
as MilliporeSigma in the U.S. and Canada.

# All You Need for a Comprehensive Analysis



Pesticides have proven to be extremely effective in warding off pests and insects that destroy growing crops. However, many chemical pesticides that get infested in soil, water, air, and food are recalcitrant in breaking down and their persistence pose a dire threat to the environment.

From collection of samples infested with pesticides from the field and their preparation for lab analysis, to comprehensive analyses of distinct pesticides – **we have the right product solutions for you.**

## QUICK NAVIGATION

# Product highlights

### 1. Sample Collection Pages 4-6 >



Glassware



Pipettes



Tubes

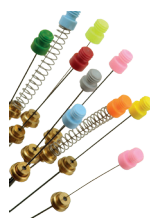
### 2. Sample Preparation Pages 7-9 >



QuEChERS



SPE



SPME



Millex® Filters

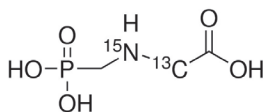


Simplicity®  
Filtration System

### 3. Standardization & Calibration Pages 10-11 >



Certified Reference Materials



Labelled Standards



General Analytical Standards ▶

### 4. Chromatographic & Separation Analysis Pages 12-14 >



UHPLC & HPLC Columns



GC Columns



Solvents

### 5. Key Application Notes Page 15 >

# 1. Sample Collection

Ensure that your samples make it to the lab for analysis with no contamination. Discover highest quality glassware, pipettes, and tubes for sample collection.



Flasks



Funnels



Cylinders



Tubes



Beakers



Bottles

## A. Glassware

All your glassware needs – brand related, and application related are fulfilled with our portfolio of multi-brand (like Pyrex®, Corning) glassware designed for multiple applications. Delve into our catalog and discover a wide selection of glassware for different capacities, in different dimensions.

Learn more about Glassware at [SigmaAldrich.com](https://www.sigmaaldrich.com)










## B. Pipettes

BRAND® offers a wide range of multi-brand, single and multi-channel pipettes for accurate pipetting of your samples.










For example the BRAND® Transferpette® S Pipette is:

- One-hand operation
- Ergonomic design for all hand sizes
- Volume-change protection prevents accidental adjustments













### Liquid Handling

Product Image	Product Description	Product Brand	QR code	Web Link
Pipettes				
	Transferpette S – Pipettes	BRAND®		
	Research Plus Pipettes	Eppendorf®		
Bottle Top Dispensers				
	Dispinettes	BRAND®		

## Repeating Pipettes

Product Image	Product Description	Product Brand	QR code	Web Link
	HandyStep S & Touch	BRAND®		
	Accu-jet® S pipette	BRAND®		
	Xplorer® Electronic Pipette	Eppendorf®		










## Consumables and Plasticware

Product Image	Product Description	Product Brand	QR code	Web Link
Pipette Tips and Tip Boxes				
	Multipipette® & Combitips®	Eppendorf®		
	Pipette Tips & Tip boxes	BRAND®		
	Pipette Tips & Tip boxes	Eppendorf®		
	Tips & Axygen	Corning®		

More on next page

### C. Tubes

The centrifuge tubes come in a variety of sizes and materials and are an essential tool for any laboratory seeking to carefully control and analyze the materials they work with. Choose the right products for you from the multitude of well-known brands.

Product Image	Product Description	Product Brand	QR code	Web Link
	Tubes centrifuge	BRAND®		
	Tubes centrifuge	Eppendorf®		
	Tubes centrifuge	Corning®		

### Labware Partners

		
<p><b>Brand® Products</b></p> <p>Brand® GmbH and BrandTech® glassware and plasticware, lab storage solutions, bottle-top dispensers, pipettes and pipette tips, cuvettes, and cell culture and PCR consumables for laboratories.</p>	<p><b>Corning® Products &amp; Labware</b></p> <p>Corning® brand glass and plastic labware, filtration membranes, cell culture supplies, and equipment for life sciences.</p>	<p><b>Eppendorf® Products</b></p> <p>Eppendorf® brand conical and microfuge tubes, pipettes and pipette tips, dispensers, centrifuges, microtiter plates, mixers, spectrometers, and PCR equipment for laboratories.</p>

## 2. Sample Preparation

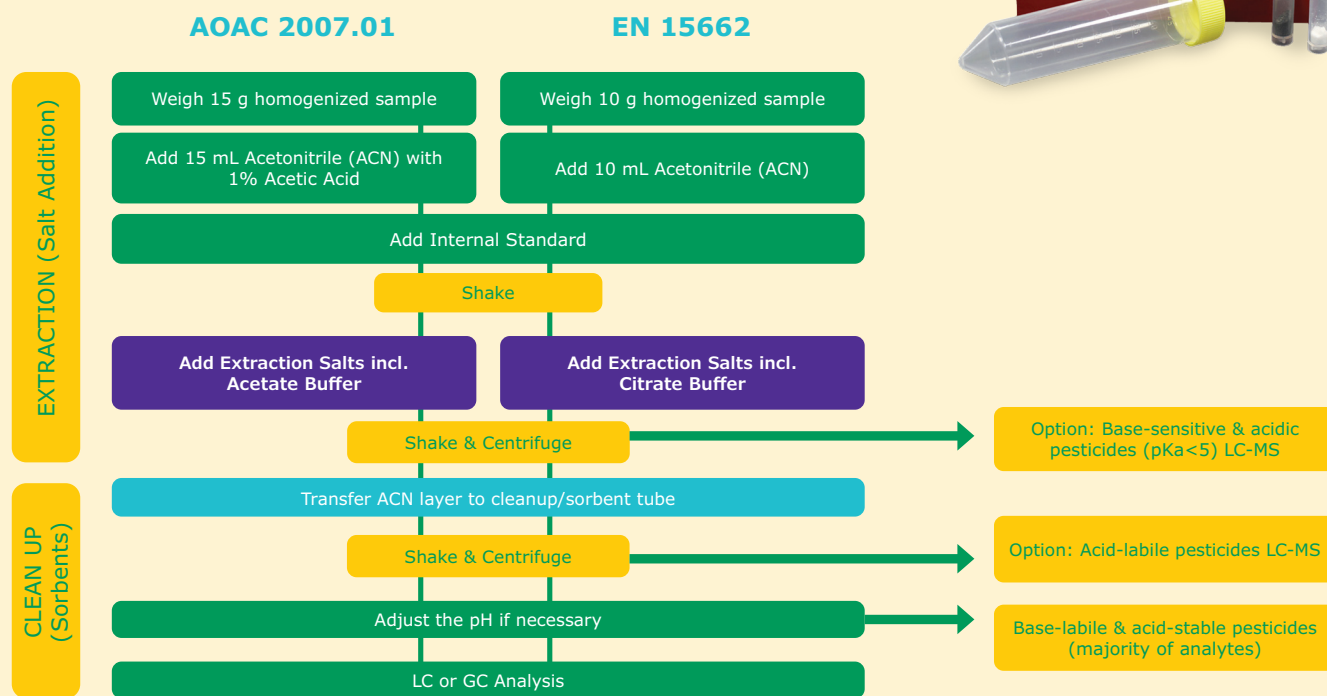
As pesticides are mostly determined in natural samples like soil and food, sample preparation is pivotal for achieving accurate and reliable results, while also maintaining stability and integrity of the analytical system.

No matter if SPE, QuEChERS, SPME, liquid extraction, or filtration is used, we can cater for the whole workflow:

### A. QuEChERS

Expanded as 'Quick, Easy, Cheap, Effective, Rugged and Safe', QuEChERS is a dispersive solid phase extraction (SPE) technique for effective sample preparation for pesticide residue analysis. Explore our range of Supel® QuE product solutions for more efficient matrix removal, higher recoveries, high sample throughput and accurate results.

#### QuEChERS Methodology



Learn more on our website: QuEChERS  
[SigmaAldrich.com/quechers](https://SigmaAldrich.com/quechers)



**Supelco®**  
Analytical Products

Read our brochure on QuEChERS:  
**Supel™ QuE**  
**Sample Preparation**



## B. Solid Phase Extraction - SPE

Select from our range of SPE cartridges, well plates, DPX tips, disks, and accessories for rapid and precise sample preparation for a successful pesticide residue analysis.

### Supelclean™ ENVI –Dedicated Environmental Products

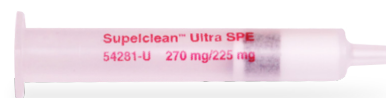
Generally made to comply to / work with US EPA & related methods

- **ENVI™-18, ENVI™-8 (tubes & disks)**
  - typically higher carbon load than common Supelclean™ equivalents
  - EPA Methods 500 series (incl. 525.1 & 508.1) e.g. pesticides in water
- **ENVI™ Florisil® (Magnesium silicate)**
  - Tested for EPA & Contract Laboratory Program (CLP) statements
- **ENVI™-Chrom P**
  - Styrene Divinylbenzene resin (900m<sup>3</sup>/g, 80-160µm)
  - e.g. aromatics & phenolic compounds from water



Learn more on our website:

Solid Phase Extraction (SPE) & QuEChERS  
**SigmaAldrich.com/spe**



### Check out our brochure on Solid Phase Extraction Products



## C. Solid Phase Microextraction - SPME

Our range of SPME product solutions, includes smart SPME fibers, Nitinol-core SPME fibers, Overcoated (OC) SPME fibers, and for a rapid, accurate solvent-free sample preparation.

### Examples of use SPME for analysis of pesticides with our different fibers like PDMS / Polyacrylat (PA) / DVB-PDMS (overcoated fiber)

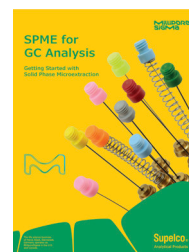
- **Organophosphate Pesticides in Water by SPME/GC**
  - SPME Fiber: polyacrylate (PA), 85µm film
- **Chlorinated Pesticides in Water by SPME/GC**
  - SPME Fiber: polydimethylsiloxane (PDMS), 100µm film
- **Nitrogen-Containing Herbicides in Water by SPME/GC**
  - SPME Fiber: polyacrylate (PA), 85µm film
- **Carbamate Pesticides in Human Body Fluids by SPME/GC**
  - SPME Fiber: polydimethylsiloxane (PDMS), 100µm film
- **Carbamate and Urea Pesticides at 1.5ppb from Water by SPME/HPLC**
  - SPME Fiber: Polydimethylsiloxane/Divinylbenzol (PDMS/DVB), 60µm film

Learn more on our website:

Solid Phase Microextraction -  
SPME **SigmaAldrich.com**



### See our brochure on SPME for GC Analysis



## D. Millex® Filters

Setting the standard in small-volume filtration (1-200 mL), the unsurpassed consistency of Millex® syringe filters in sample preparation has led to the development of many methods specifying their use.

Featuring reduced sample loss due to minimal hold-up volumes and low binding membranes, Millex® syringe filters are ideal for use in a variety of applications including:

- HPLC and other analytical instruments' sample preparation
- Food and Beverage sample preparation
- Water and soil analysis

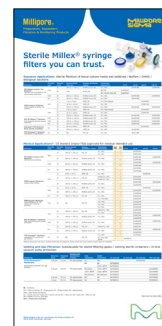
Low extractable and high flow Millex® syringe filters will help to generate reproducible results with difficult to filter substances and samples



Learn more:  
Millex® Syringe Filters [SigmaAldrich.com/Millex](https://SigmaAldrich.com/Millex)



### Get the Millex® Wall Chart



## E. Smplicity® Filtration System

Love Millex® filters, but have tired thumbs?

For chromatographers who filter dozens of samples a day through Millex® syringe filters, especially for hard-to-filter, viscous or particulate-laden samples, traditional filtration can lead to manual fatigue, and even repetitive stress injury. Nevertheless, they stick with Millex® filters, which are specified in numerous analytical methods and standard operating procedures.

Introducing the Smplicity® G2 Filtration System for Millex® Filters. By adding a simple adapter funnel to standard Millex® 33 mm filters, we've enabled easy, vacuum-driven filtration of up to 8 samples at once, directly into HPLC vials, in seconds.



Learn More:  
[SigmaAldrich.com/Smplicity](https://SigmaAldrich.com/Smplicity)



### Read our Smplicity® brochure



# Millipore®

Preparation,  
Separation, Filtration  
& Monitoring Products

# 3. Standardization & Calibration

Standardization in pesticide residue analysis ensures accurate monitoring of soil, water, and food quality in accordance with national and international regulations.

Explore our vibrant range of certified reference materials, labeled standards, and general analytical standards.

## A. Certified Reference Materials

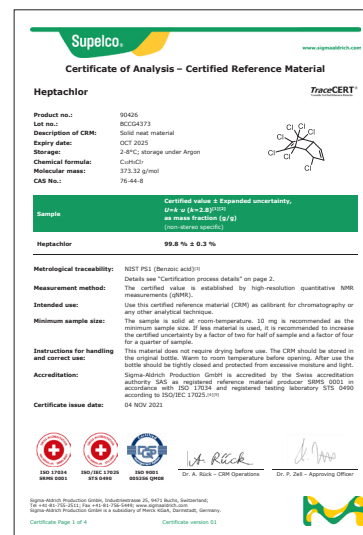
For ISO/IEC 17025 accredited labs, it is mandatory to show traceability of all results, therefore certified reference materials (CRMs) must be used for calibration.

Our rapidly expanding TraceCERT® product range includes an increasing number of CRMs for pesticides. Our ISO/IEC 17025 and ISO 17034 double accreditation is the highest achievable quality level for reference material producers, which ensures the quality of your reference materials.

Our neat CRMs are certified by quantitative NMR (qNMR) or mass balance approach and are traceable to NIST SRM (National Institute of Standards and Technology – Standard Reference Materials). The CRM solutions are produced gravimetrically using NIST traceable weights for balance calibration.

### Highlights:

- Supplied with a comprehensive certificate according to ISO Guide 31 specifications
- Packed in vials or amber glass ampules for convenience and better stability
- Multiple uses - As calibration standards, internal standards, surrogate standards, spiking solutions, or laboratory control samples (LCSs)
- Available in neat format, single-component solutions, or multi-component solutions



Certificate of Analysis of TraceCERT® CRM



Learn more:  
[SigmaAldrich.com/  
pesticide-standards-pestanal](https://sigmaaldrich.com/pesticide-standards-pestanal)



## B. Labeled Standards

Discover our range of  $^{13}\text{C}$ ,  $^{15}\text{N}$  or D-labeled pesticide standards suitable for Isotope Dilution Mass Spectrometry (IDMS), available in neat, and solution formats. Spike up your samples with our isotope labeled pesticides and accurately compensate for losses of the analytes during workup.

We are continuously adding new isotopically labeled standards for pesticide and pesticide metabolite analysis to our already extensive portfolio of over 150 products.

### Links to Labeled Pesticide Standards



## C. General Analytical Standards

Our Pestanal<sup>®</sup> grade of pesticide analytical standards are specifically designed for your routine analyses or screening tests. Choose from our wide variety of neat or solution standards. Our range of neat pesticides comprises mother substances along with an increasing list of metabolites. To ensure the utmost transparency, we provide a certificate of analysis which consists of:

- Purity and identity data
- Chromatogram
- Expiry date
- Additional information if applicable, e.g., water content



Learn more on our website:  
[SigmaAldrich.com/  
pesticide-standards-pestanal](https://sigmaaldrich.com/pesticide-standards-pestanal)



**we reap what we sow!**  
A talk about Emerging Contaminants



[Watch now >](#)



**Supelco<sup>®</sup>**




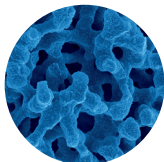


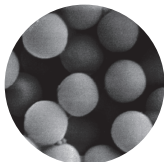


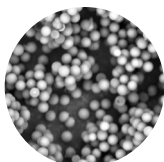


## 4. Chromatographic & Separation Analysis

### A. UHPLC/HPLC Columns

The Supelco® HPLC & UHPLC column portfolio meets today's challenging needs of Fast HPLC including UHPLC and LC-MS.

Fused-Core® technology, monolithic silica, ultra-pure silica, polymeric particles, and porous graphitic carbon (PGC) particles are some of the stationary phase platforms that make up the Supelco® HPLC product line providing specific benefits for the HPLC analysis of pesticides.



	Product Description	QR code	Link
	<b>Superficially porous silica particles (SPP)/Fused-Core® technology</b> <p>Superficially porous silica columns deliver higher speed and efficiency than fully porous particles of the same size. Fused-Core® HPLC columns such as <b>Ascentis® Express</b> can convert any HPLC system into a fast HPLC workhorse with maximum speed and performance.</p>		
	<b>Monolithic silica columns</b> <p>Monolithic silica based <b>Chromolith®</b> HPLC columns allow rapid separations at very low column backpressure with high matrix tolerance and extended column lifetime, thus making them ideal products for high throughput and cost-efficient analyses of matrix-rich samples.</p>		
	<b>Fully porous silica particles (FPP) type B</b> <p><b>Purospher® STAR</b> HPLC and UHPLC columns are best suited for the peak-tailing free separation of basic, neutral, and metal chelating samples. Their superior performance and stability allow maximum flexibility in method development with extended pH stability.</p> <p><b>Discovery®</b> and <b>Ascentis®</b> bonded phases have a wide range of selectivities.</p> <p><b>SeQuant®</b> HILIC (hydrophilic interaction liquid chromatography) HPLC columns carry densely bonded, zwitterionic functional groups. These columns are superior for the separation of very polar compounds while showing an exceptional reproducibility and robustness.</p>		
	<b>Porous graphitic carbon (PGC) particles</b> <p>Porous graphitic carbon (PGC) columns, like the <b>Supel™ Carbon LC column</b>, provide unique chromatographic properties that are unmatched by silica particle-packed columns. The full pH range can be used as well as high temperature (&gt; 200 °C), opening new frontiers for chromatographers. This column is an excellent choice for the separation of polar pesticides such as Glyphosate.</p>		

## Recommendations:

For effective LC-MS of non-polar pesticides, we recommend the fully porous Ascentis® columns possessing the highest sample capacity with a wide phase choice. Furthermore, Ascentis® Express columns packed with superficially porous particles that have the highest efficiency and wide phase selection, and the Chromolith® monolithic silica columns available with 2 mm I.D, featuring a high degree of matrix robustness and low backpressure, are also suitable for analyses of non-polar pesticides.

For polar pesticides, we recommend our patented unique, consistent Carbon LC or our wide range of HILIC columns, such as SeQuant® ZIC®-HILIC, ZIC®-cHILIC or Ascentis® Express OH5 as well as plain silica columns in the Ascentis®, Ascentis® Express and Chromolith® product range.

Try our Chromatogram Search Tool



## B. GC Columns

We carry a wide range of GC columns developed to suit industry-specific applications, and to characterize diverse compounds rapidly. Our GC columns vary in their material of make, type and dimensions.

For the GC-MS analysis of pesticides recommended columns are the SLB®-5ms, Equity®-5, SPB®-608 and the Equity®-1701. However, our Supelco portfolio includes a unique range of non-polar to extremely polar GC columns, thereby allowing full analysis including multi-dimensional GC x GC applications. Our GC-MS Selection Guide can provide further information.

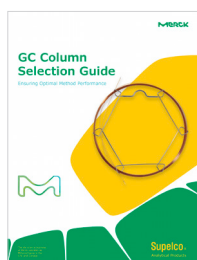
Visit our website for more information:

**GC Columns,  
Accessories & Adsorbents**

**SigmaAldrich.com/GC**



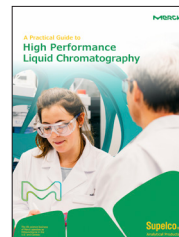
For an overview on our GC phases see our **GC Column Selection Guide**.



Our HPLC and UHPLC Column Selection Guide can provide further information.



Also check out our HPLC Method Development guide.



### Links to suitable GC columns:

SLB®-5ms



SPB®-608



Equity®-1701



**Supelco®**  
Analytical Products



## C. Solvents

Our **HPLC family of high-purity HPLC solvents** delivers superior purity, stability, and lot-to-lot consistency, making them ideal for a variety of analytical separations including LC-MS, HPLC and GPC.

LiChrosolv® hyper grade is accurately tested for LC-MS suitability and meets all the requirements of modern LC-MS ionization methods (ESI/APCI - positive and negative mode). Thanks to their low level of ionic background and low ion suppression, LiChrosolv® hyper grade solvents provide high reproducibility and high ionization efficiency. The packaging material has been improved to meet LC-MS quality requirements perfectly.

### Features & Benefits

- Suitability tested and specified for UHPLC-MS and UHPLC-UV: for analytical flexibility
- Specified quality in positive and negative ESI and APCI MS for lowest detection limits and confidence in analyses in all important MS modes
  - ESI/APCI (+) < 2 ppb
  - ESI/APCI (-) < 10 ppb
- Lowest impurity profile: for interference-free baselines
- Microfiltered through 0.2 µm filter, helping in:
  - prolonged lifetime of filters and mechanical parts in HPLC systems
  - reduced risk of column clogging
- Packaged in borosilicate glass bottles: minimized contamination with metal ions adduct formation <5ppb

Explore our complete offer of solvents at [SigmaAldrich.com/solvents](https://www.sigmaaldrich.com/solvents)

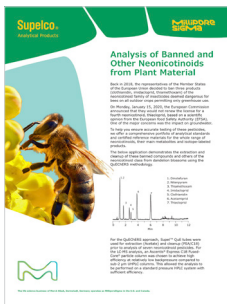


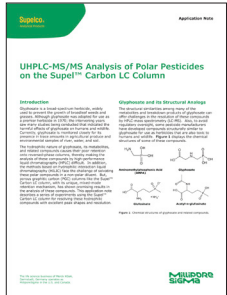





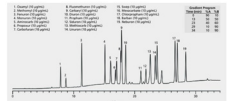


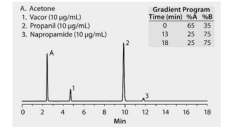


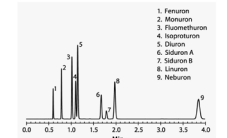






For your highly sensitive UHPLC-MS analyses, how can you reduce noise and additional signals to a minimum?

Our new high-end UHPLC-MS solvents raise the standard for low baseline noise and clean mass spectra.

Our new range of advanced UHPLC-MS LiChrosolv® solvents has been developed to exceed all expectations, providing rapid and reliable results in both ESI/APCI positive and negative ionization modes.



# 5. Key Application Notes

Application Note	QR code	Link
 <p><b>Analysis of Banned and Other Neonicotinoids from Plant Material</b></p>		
 <p><b>UHPLC-MS/MS Analysis of Polar Pesticides on the Supel™ Carbon LC Column</b></p>		
 <p><b>Complete Workflow for the Analysis of California List of Pesticides in Cannabis by LC-MS/MS and GC-MS/MS</b></p>		
 <p><b>US EPA Method 632: HPLC Analysis of Pesticides on Ascentis® C18</b></p>		
 <p><b>HPLC Analysis of Pesticides on Ascentis® C8</b></p>		
 <p><b>HPLC Analysis of Phenyl Urea Pesticides on Ascentis® Express C18 Phase</b></p>		
<p>See more technical articles and protocols on pesticides here</p>		
<p>Or a wide selection of chromatograms</p>		

Merck has brought together the world's leading Life Science brands, so whatever your life science problem, you can benefit from our expert products and services.

**Supelco®**

Analytical Products

The Supelco® portfolio of analytical solutions of Merck is developed by analytical chemists for analytical chemists to ensure your results are accurate, precise and reproducible. Every product is meticulously quality-controlled to maintain the integrity of your testing protocols and, with our dedicated scientists, the expertise you need is always on hand.

**Millipore®**

Preparation, Separation,  
Filtration & Monitoring Products

The Millipore® portfolio of Merck offers an ecosystem of industry-leading products and services, spanning preparation, separation, filtration and monitoring – all of which are deeply rooted in quality, reliability and time-tested processes. Our proven products, regulatory and application expertise are a strong foundation you can rely on to consistently perform at the highest level.

**Sigma-Aldrich®**

Lab & Production Materials

The Sigma-Aldrich® portfolio of Merck offers a strong and ever-expanding offering of lab and production materials. Through our technical support and scientific partnerships, we help connect our customers with a whole world of progress.



To place an order or receive technical assistance in Europe, please call Customer Service:

Germany: 0800 / 515 5000

France: 0800 211408

Austria: 0820 / 874 464

Spain: 90 01 01 376

Switzerland: 0848 / 645 645

UK: (0)8 00 71 71 81

Italy: 800 827018

For other countries across Europe, please call: +44 (0) 115 943 0840

Or visit: [SigmaAldrich.com/offices](https://SigmaAldrich.com/offices)

For Technical Service visit: [SigmaAldrich.com/techservice](https://SigmaAldrich.com/techservice)

Merck KGaA  
Frankfurter Strasse 250  
64293 Darmstadt, Germany

[SigmaAldrich.com](https://SigmaAldrich.com)

We have built a unique collection of life science brands with unrivalled experience in supporting your scientific advancements.

**Millipore** **Sigma-Aldrich** **Supelco** **Milli-Q** **SAFC** **BioReliance**

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