Vitamin Testing

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- Accurate, reproducible results

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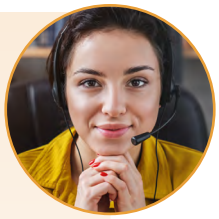

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VITAMIN TESTING

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Methylmalonic Acid (MMA) From Plasma

Sample Preparation

Combine 0.5 mL of 1 % aqueous Acetic Acid and 50 µL of internal standard with 100 µL blank, standard, or sample

SPE Method

Cartridge: Strata™-X-AW 30 mg/1 mL
Part No.: 8B-S038-TAK
Condition: 1 mL of Methanol
Equilibrate: 1 mL of 1 % Acetic Acid in Water
Load: Pretreated sample
Wash: 0.5 mL Methanol/Water (50:50)
Dry: 5-10 min at max vacuum (or positive pressure)
Elute: 2x 0.6 mL 2 % NH_4OH in Methanol
Evaporate: Evaporate solvent to dryness @ 45-50 °C under a gentle stream of Nitrogen
Reconstitute: 200 µL 0.1 % Formic Acid in Water

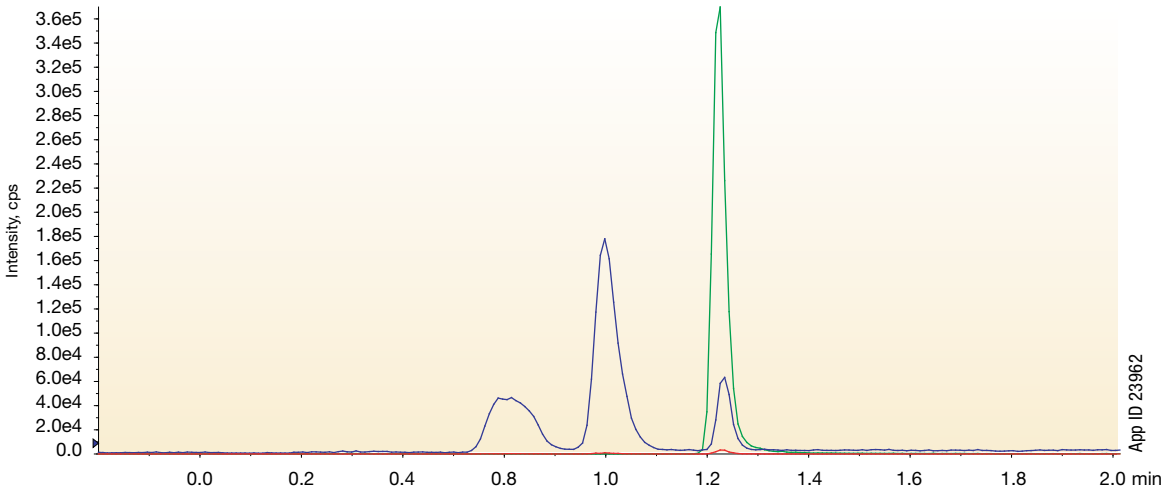
LC Conditions

Analytical Column: Luna™ Omega 1.6 µm PS C18
Dimensions: 50 x 2.1 mm
Part No.: 00B-4752-AN
Guard Cartridge: SecurityGuard™ ULTRA AF0-8497
Mobile Phase: A: 0.1 % Formic Acid in Water
B: 0.1 % Formic Acid in Acetonitrile

Gradient:

Time (min)	B (%)
0.01	2
2	90
3	90
3.01	2
5	2

Flow Rate: 0.4 mL/min
Injection Volume: 5 µL
Temperature: 40 °C



Representative chromatogram of an extracted sample. Pooled human plasma was spiked with standards to 1.5 µg/mL of succinic acid and 750 nmol/L of methylmalonic acid above the endogenous concentrations and processed by solid phase extraction. Peaks in order of elution: plasma interference (0.81 min), succinic acid (1.00 min), methyl-D3-malonic acid (1.20 min), and methylmalonic acid (1.23 min)

MS/MS Source Conditions

Detector: SCIEX® 4000 QTRAP®
Mode: Negative Ionization Mode
Scan Type: MRM
Curtain Gas (CUR): 10.0 psi
Collision Gas (CAD): Medium
IonSpray Voltage (IS): -4500 V
Temperature (TEM): 600 °C
Ion Source Gas 1 (Gas1): 50 psi
Ion Source Gas 2 (Gas2): 50 psi
Interface Heater (ihe): On

Have different front end systems or require different methods?

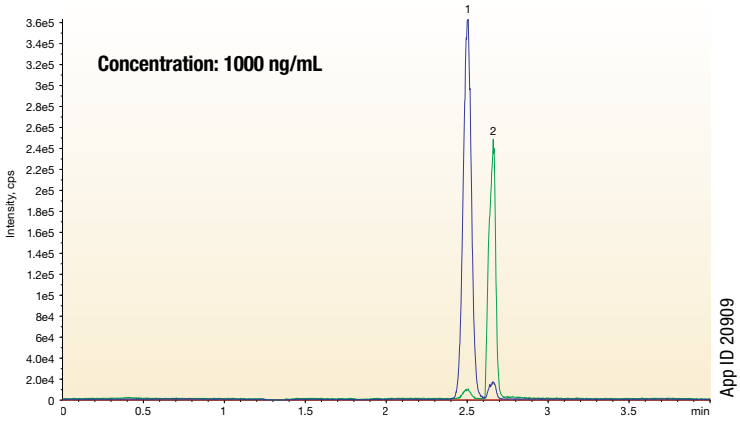
Contact us to discuss Sample Prep or Column options available.

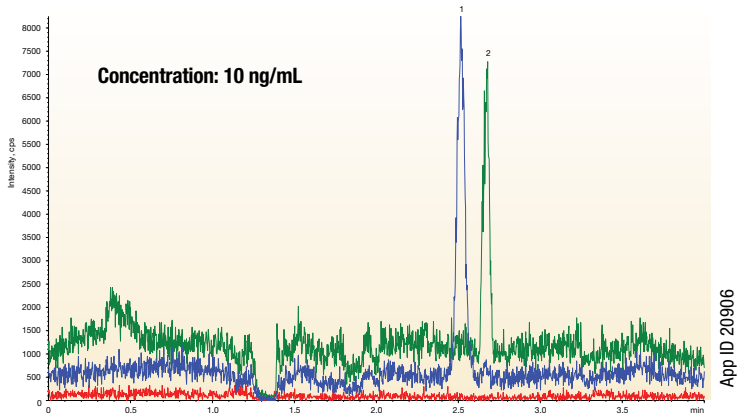
Vitamin B3 from Plasma

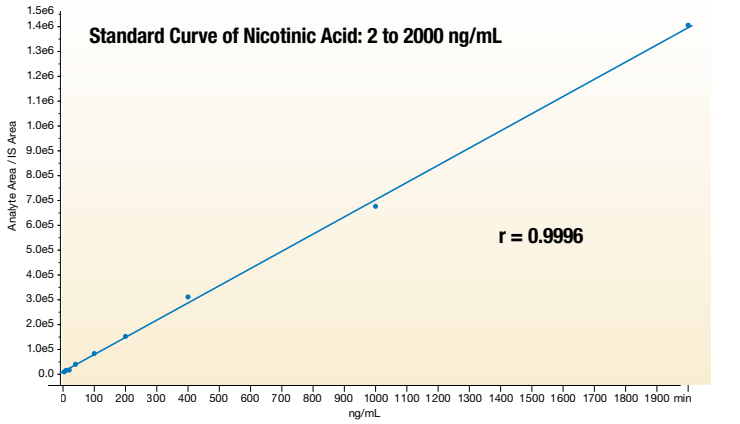
Nicotinic Acid and Nicotinamide by LC-MS/MS

Sample Preparation

1. Add 300 µL Acetonitrile to a well of an Impact™ Protein Precipitation Plate.
2. Add 100 µL plasma/serum to the well. Mix 3 times with a pipette tip (or vortex the whole plate briefly).
3. Filter under vacuum (5mm Hg) for 5 minutes. Ensure that a collection plate is positioned underneath the Impact Protein Precipitation Plate.
4. Cover collection plate with a sealing mat. Sample is now ready to be injected onto the LC-MS/MS. If sample will not be injected immediately, transfer the filtrate to an amber Verex™ autosampler vial (ambient) to protect from light.







LC-MS/MS Conditions

Column:	Gemini™ 3 µm C18
Dimensions:	100 x 4.6 mm
Part No.:	00D-4439-E0
Guard:	SecurityGuard™ cartridge C18, 4 x 3.0 mm
Part No.:	AJ0-7597 + KJ0-4282
Mobile Phase:	A: 0.1 % Formic Acid in Water B: Methanol

Gradient:

Time (min)	% B
0	10
2.5	90
2.6	10
4	10

Flow Rate:	0.6 mL/min
Temperature:	22 °C
Injection Volume:	2 µL
Detector:	MS/MS (SCIEX® API 4000™) ESI+
Samples:	1. Nicotinamide 2. Nicotinic Acid

Data Summary

Analyte	LOD		LOQ	
	ng/mL	S/N Ratio	ng/mL	S/N Ratio
Nicotinamide	2	4.3	10	12.4
Nicotinic Acid	2	3.3	10	10.1

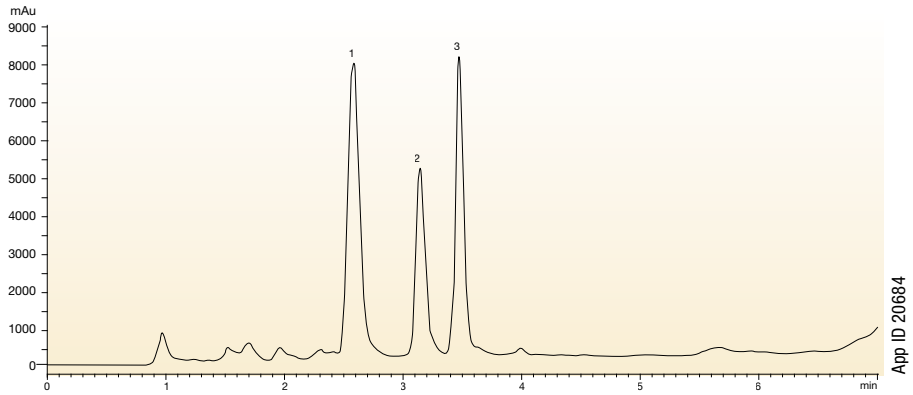
Vitamin B6 from Plasma

Pyridoxal 5'-Phosphate (PLP), 4-Pyridoxic Acid (PA), and Pyridoxal (PL) by HPLC-Fluorescence

Sample Preparation

1. Thaw plasma samples and plasma/serum spiked calibrators or pre-manufactured calibration standards and controls at ambient temperature. Protect from light.
2. Pipette 200 µL plasma blank, calibration standards, controls, and plasma samples into appropriately labeled 0.6 mL amber microcentrifuge tubes.
   - Briefly vortex the calibrators and controls immediately prior to sampling.
   - Mix the plasma samples by gentle inversion immediately prior to sampling.
   - Protect the tubes from light.
3. Add 30 µL of 100 mg/mL semicarbazide/glycine solution into all the tubes containing samples; cap the tubes, vortex for 15 sec.
4. Incubate in the dark at room temperature for 30 min.
5. Uncap the tubes; add 25 µL of 20 % meta-phosphoric acid to the controls and samples.
6. Recap the tubes and vortex for 30 sec.
7. Centrifuge for 5 min at 14,000 rpm at room temperature.
   Note: The relative centrifugal force (RCF) = 16,000 g.
8. Transfer 150 µL of supernatant to an amber autosampler glass Verex™ vial.
9. Cover the vial with a screw cap and place it in the autosampler at room temperature.

HPLC-Fluorescence Conditions



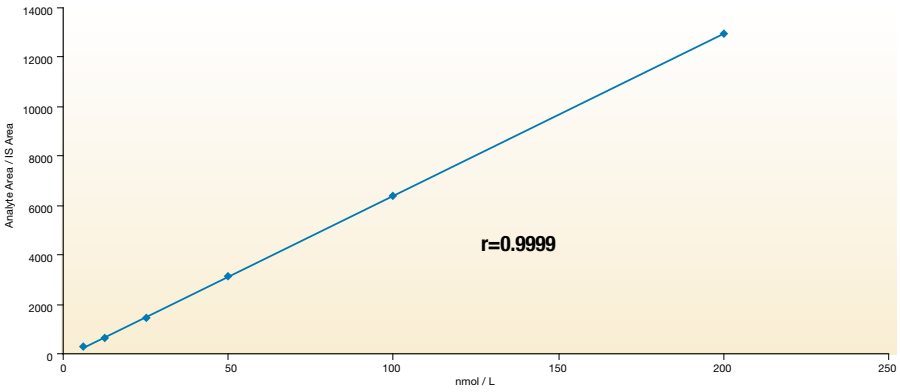
Column: Gemini™ 3 µm NX-C18
Dimension: 100 x 4.6 mm
Part No.: 00D-4453-E0
Guard: SecurityGuard™ guard cartridge system
Part No.: AJ0-8368 + KJ0-4282
Mobile Phase: A: 20 mM Sodium phosphate and 1.0 mL Acetic acid in 1 L DI water, pH 6
B: Acetonitrile/Methanol (70:30)

Gradient:

Time (min)	%B
0.0	5
5.0	60
5.1	95
6.0	5
7.0	5

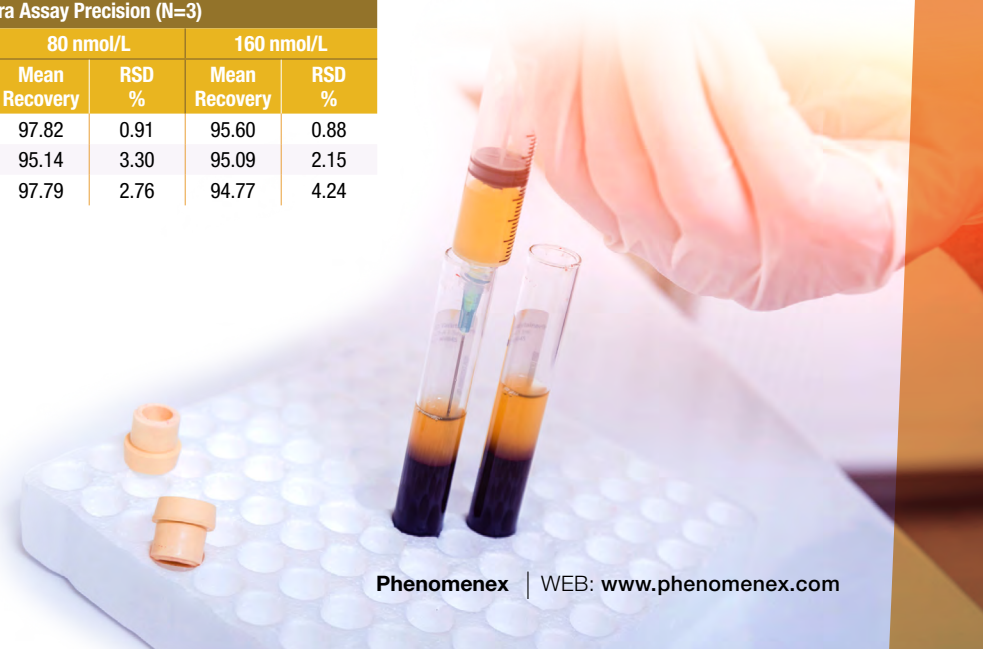
Flow Rate: 1 mL/min
Column Temp: 35 °C
Injection Volume: 30 µL
Detection: Fluorescence, Ex 360, Em 450
Sample: 1. Pyridoxal 5'-phosphate
2. 4-Pyridoxic Acid
3. Pyridoxal

Representative calibration curve for Pyridoxal 5'-phosphate. The method was linear across the concentration range of 6.25-200 nmol/L.



Data Summary
Statistical data of PLP, PA, and PL in plasma.

Analyte	LOD	LOQ	Intra Assay Precision (N=3)					
	nmol/L	nmol/L	8 nmol/L		80 nmol/L		160 nmol/L	
			Mean Recovery	RSD %	Mean Recovery	RSD %	Mean Recovery	RSD %
PLP	2	4	86.95	2.50	97.82	0.91	95.60	0.88
PA	2	4	94.96	4.33	95.14	3.30	95.09	2.15
PL	2	4	91.59	4.50	97.79	2.76	94.77	4.24



Vitamin C from Plasma

Ascorbic Acid by LC-UV

Sample Preparation

Rapid Protein Precipitation:

Add 300 µL cold 5 % Meta-phosphoric Acid (4 °C) to the wells of an Impact™ Protein Precipitation Plate (see pg. 11 for ordering information).

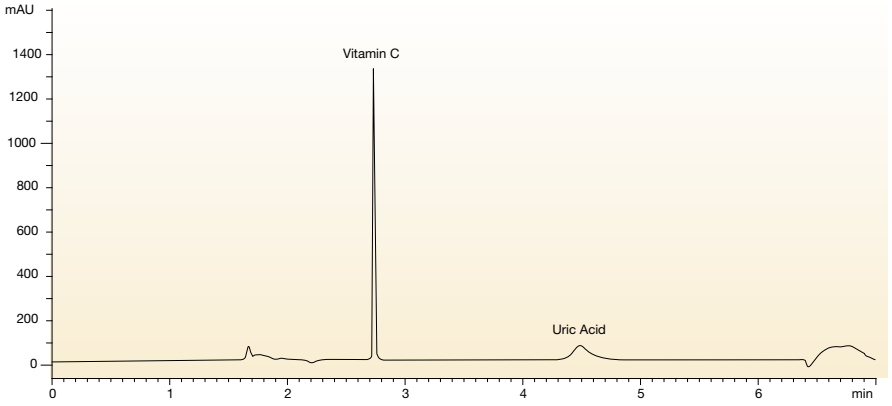
Add 100 µL plasma/serum directly into the 5 % Meta-phosphoric acid.

Mix 5 times by aspirating with same pipette tip.

Centrifuge* the Impact plate at 500 g (with collection plate underneath) for 5 min at 4 °C. Purified filtrate is collected in the collection plate.

* A vacuum manifold may be used however 25mm Hg vacuum pressure must be applied for up to 10 minutes or until sample is completely pulled through the Impact plate

LC-UV Conditions



App ID 21441

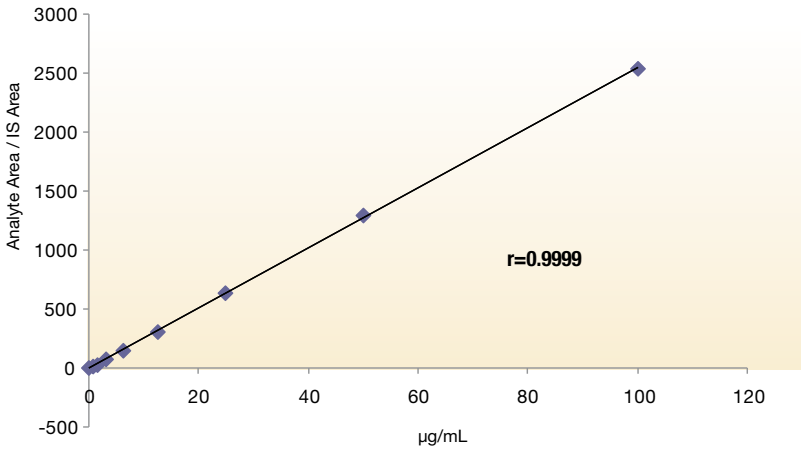
Column: Kinetex™ 5 µm XB-C18
Dimension: 150 x 4.6 mm
Part No.: 00F-4605-E0
Guard: SecurityGuard™ ULTRA guard cartridge system
Part No.: AJ0-8768 + AJ0-9000
Mobile Phase: A: 0.1 % Formic Acid in Water
B: Acetonitrile

Gradient:

Time (min)	%B
0.0	0
3.5	0
3.6	100
5.0	100
5.1	0
7.0	0

Flow Rate: 0.8 mL/min
Column Temp: 22 °C
Injection Volume: 30 µL
Detection: UV-Vis @ 245 nm
Sample: 1. Vitamin C (Ascorbic Acid)
2. Uric acid

Representative calibration curve for Vitamin C. The method was linear across a concentration range of 0 - 100 µg/mL.



Recovery of Vitamin C from spiked human plasma

Added Vitamin C (µg/mL)	Observed (µg/mL)	Recovery (%)
0	5.0	-
3	7.9	98.8
5	9.0	90.0
10	14.1	94.0
20	24.8	99.2
30	35.1	100.3
40	46.8	104.0
60	65.5	100.8
	Mean	98.2
	CV	4.8

Intra- and inter-day imprecision of plasma Vitamin C analysis

	Intra Imprecision (n=12)			Inter Imprecision (n=6)		
	Mean (µg/mL)	SD	% CV	Mean (µg/mL)	SD	% CV
QC 1	1.1	0.0309	2.90	1.1	0.0532	4.82
QC 2	11.2	0.3552	3.16	11.1	0.3857	3.47
QC 3	34.1	0.5910	1.74	34.9	0.6290	1.80

25-OH Vitamin D2, 25-OH-Vitamin D3, and 3-Epi-25-OH-Vitamin D3 from Human Serum

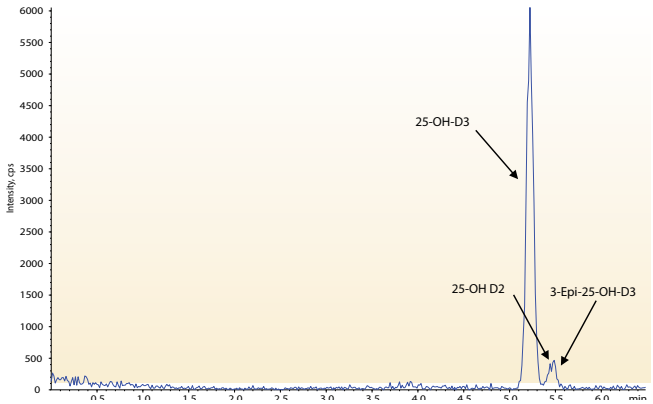
by On-line SPE-LC-MS/MS

Sample Preparation

Precipitate 100 µL of human serum by adding 200 µL 5:2:1 Methanol: Acetonitrile: 2 % $ZnSO_4$ and 30 µL of 1 µg/mL working internal standard in water, mix and centrifuge. Inject supernatant.

On-line SPE-LC-MS/MS Conditions

On-line SPE Extraction Cartridge: Strata™ C8 20 µm
Dimension: 20 x 20 mm
Part No.: 00M-S101-B0-CB
Column: Kinetex™ 2.6 µm F5
Dimension: 100 x 4.6 mm
Part No.: 00D-4723-E0
Mobile Phase: A: 0.1 % Formic Acid in Water
B: 0.1 % Formic Acid in Methanol (A/B 15:85)
Flow Rate: 750 µL/min
Needle Wash: Wash 1: Methanol/Water (50:50)
Wash 2: 0.1% Formic Acid in Water
Injection Volume: 40 µL
Detection: MS/MS (SCIEX® API 4000™ QTRAP®), APCI+
Sample: 1. 25-OH Vitamin D3
2. 3-epi-25 OH Vitamin D3
3. 25-OH Vitamin D2



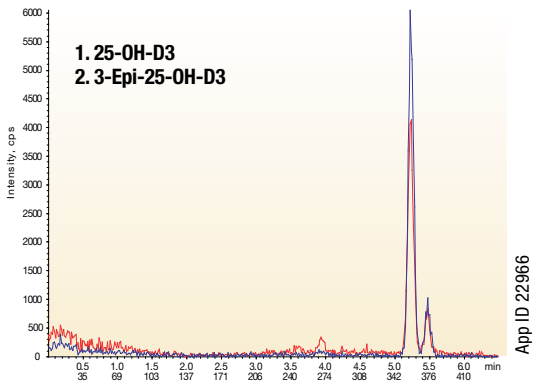
App ID 22965

LC Conditions: Thermo Cohesive® System

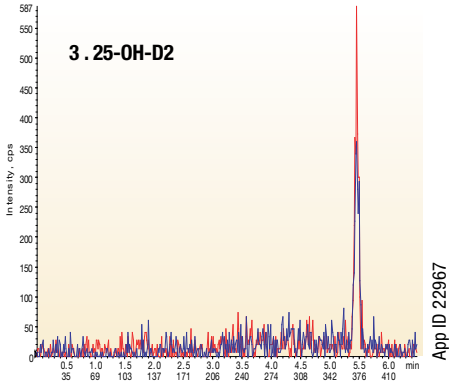
			Loading Pump								Eluting Pump				
Step	**Start**	**Sec**	**Flow**	**Grad**	**%A**	**%B**	**%C**	**%D**	**Tee**	**Loop**	**Flow**	**Grad**	**%A**	**%B**	**Comments**
1	0.00	30	0.75	Step	30.0	70.0	-	-	-	Out	0.75	Step	20.0	80.0	Extract sample
2	0.50	5	0.33	Step	15.0	85.0	-	-	-	Out	0.33	Step	20.0	80.0	Slow down pumps
3	0.58	30	0.33	Step	15.0	85.0	-	-	T	In	0.33	Step	15.0	85.0	Transfer analytes
4	1.08	60	1.50	Step		100.0	-	-	-	Out	0.75	Ramp	15.0	85.0	Separate analytes, wash extraction column
5	2.08	120	1.50	Step		100.0	-	-	-	Out	0.75	Step	15.0	85.0	Elute analytes, wash extraction column
6	4.08	30	0.75	Step	15.0	85.0	-	-	-	In	0.75	Step	20.0	80.0	Wash columns and valves
7	4.58	60	0.75	Step	30.0	70.0	-	-	-	In	0.75	Step	20.0	80.0	Fill transfer loop, equilibrate HPLC column
8	**5.58**	**90**	**0.75**	**Step**	**30.0**	**70.0**	**-**	**-**	**-**	**Out**	**0.75**	**Step**	**20.0**	**80.0**	**Equilibrate columns**

Focus Mode Configuration

Representative Chromatograms of LLOQ (2.5 ng/mL) in Human Serum



App ID 22966

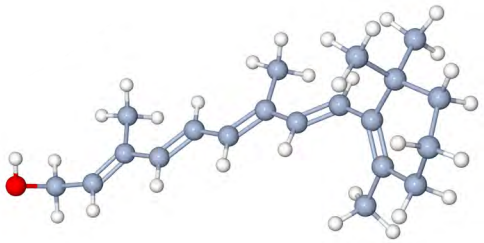


App ID 22967

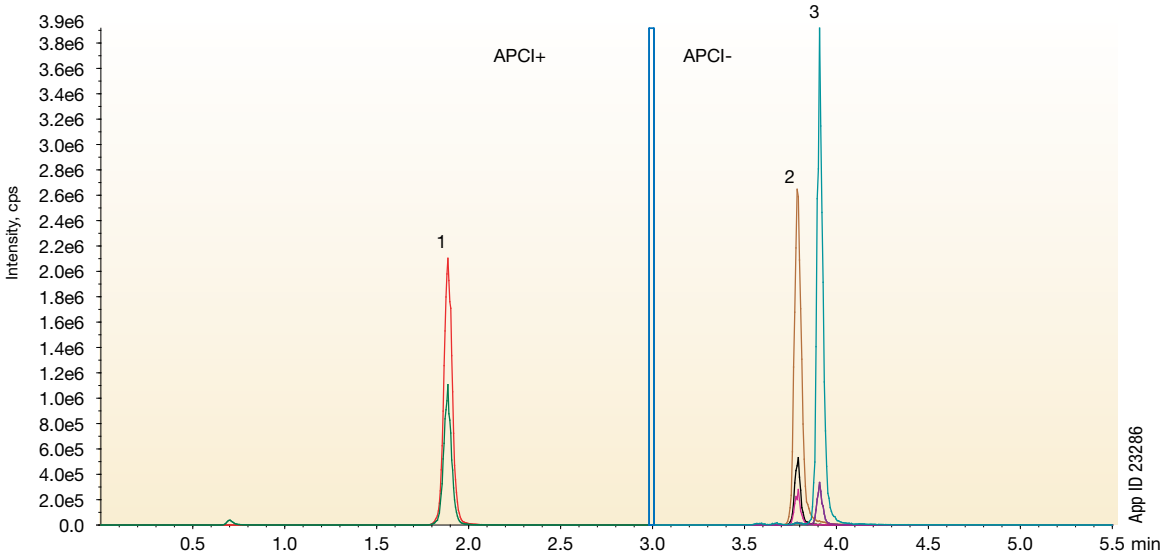
Vitamin A and E from Human Serum by LC-MS/MS

Sample Preparation

1. Dilute 200 µL human serum with 100 µL Isopropanol (IPA) and 150 µL of water. Vortex 30 seconds.
2. Load onto the Novum™ MAX 96-well plate (Part No.: 8E-S138-5GA). Apply a short pulse of vacuum for 10-15 seconds.
3. Wait 5 minutes.
4. Elution: Dispense Ethyl Acetate/Acetone (90:10), 2 x 900 µL (2 aliquots) to elute by gravity (~ 5 minutes) and collect the eluent. Apply vacuum at 5mm Hg for 20-30 secs to complete the extraction.
5. Dry down: Evaporate the final extract to complete dryness under slow stream of nitrogen at 45 °C.
6. Reconstitute: Dried residue in 200 µL of initial mobile phase.



LC-MS/MS Analysis of Vitamin A and E Using Dual Polarity Technique in MS



Column: Kinetex™ 5µm EVO C18
Dimensions: 100 x 2.1mm
Part No.: 00D-4633-AN
Mobile Phase: A: Water
B: Isopropanol/acetonitrile (1:1)

Gradient:

Time (min)	B (%)
0.0	65
3.5	95
4.0	95
4.1	65
5.05	65

Flow Rate: 0.6 mL/min
Injection Volume: 5 µL
Temperature: Ambient

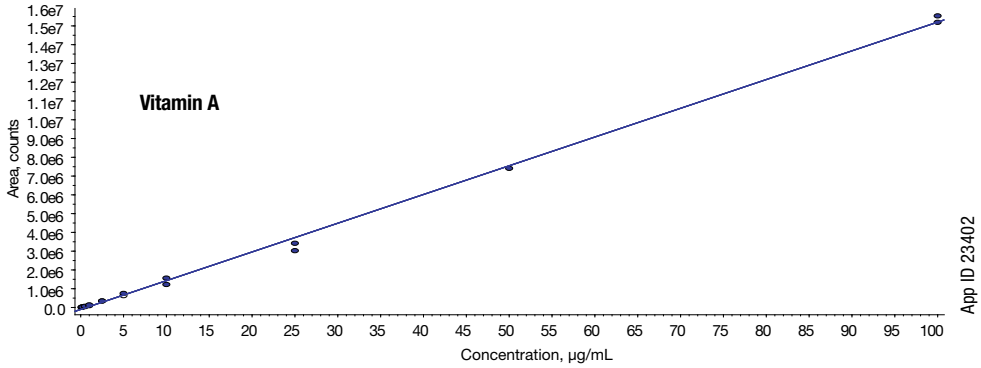
Instrument: Agilent® 1260
MS/MS Instrument: SCIEX® Triple Quad™ 5000
Analyte: 1. Vitamin A (retinol)
2. γ-Tocopherol (Vitamin E)
3. α-Tocopherol (Vitamin E)

Have different front end systems or require different methods?

Contact us to discuss Sample Prep or Column options available.

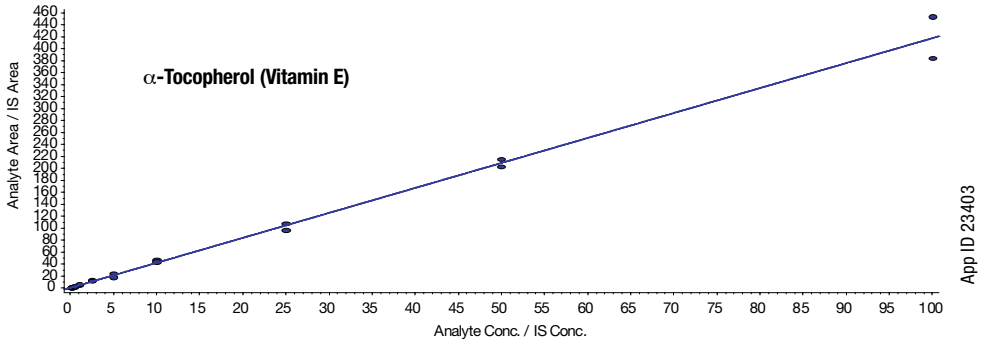
Linearity Curve of Vitamin A Extracted Samples on Novum™ MAX

(Matrix: Doubly-Charcoal Stripped Serum)



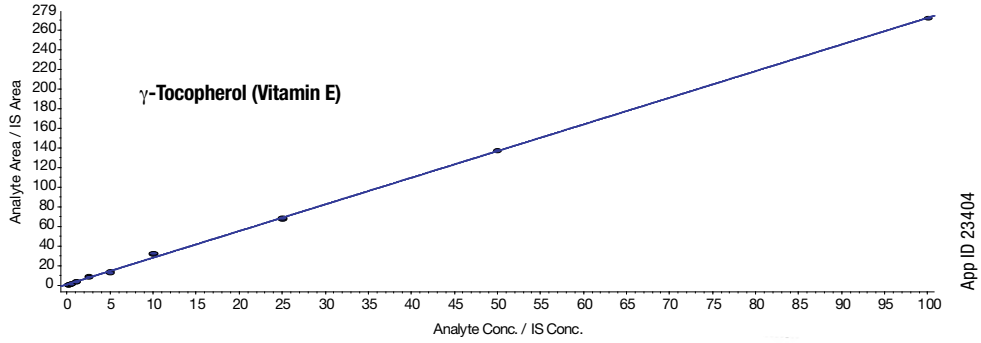
Linearity Curve of α-Tocopherol Extracted Samples on Novum MAX

(Matrix: Egg White Albumin)



Linearity Curve of γ-Tocopherol Extracted Samples on Novum MAX

(Matrix: Egg White Albumin)



Improved Recovery and Cleanliness (92-110 %; CV=2-9 %) from Novum Max

Analyte	% Recovery
Vitamin A	92
α-Tocopherol (Vit E)	105
γ-Tocopherol (Vit E)	110

High pH Vitamin B1 and B6 in Whole Blood

Experimental Conditions

Optimized Sample Extraction Method

Human whole blood samples were frozen immediately at -20 °C after collection. It is important to freeze the sample for at least 24 hours prior to analysis in order to prevent the analyte from decomposition, especially TDP.

1. Pipette 100 µL of thawed hemolyzed blood into a 1.8 mL centrifuge tube
2. Add 300 µL of working internal standard (20 ng/mL of Pyridoxine-D_2 and 50 ng/mL of Thiamine-$^{13}C_4$ in DI water) and mix for 30 seconds
3. Add 30 µL of 70 % $HClO_4$ and mix for 1 minute to precipitate proteins
4. Centrifuge sample at 14,000 rpms for 10 minutes to pellet the protein
5. Transfer 200 µL of supernatant into an autosampler vial for LC MS/MS analysis

Note: Since the analytes are light sensitive, the extraction steps were performed in amber color centrifuge tube and were protected from light.

LC/MS/MS Method Parameters

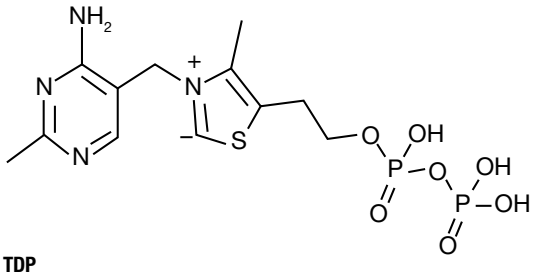
Column: Gemini® 5 µm C18
Dimensions: 50 x 4.6 mm
Part No.: 00B-4435-E0
SecurityGuard Cartridge: AJ0-7597
Mobile Phase: A: 10 mM NH_4HCO_3 in water, pH8.8
B: Methanol

Gradient:

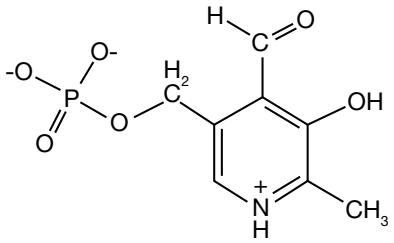
Time (min)	B (%)
0.01	0
1.5	0
5	60
6.5	60
6.51	0
9	0

Flow Rate: 600 µL/min
Injection Volume 10 µL
Instrument: Agilent® 1260 LC
Detection: MS/MS (ESI+) (SCIEX API 4500™)
Sample: 1. Pyridoxal 5-phosphate (PLP)
2. Thiamine Diphosphate (TDP)
3. Pyridoxine D_2
4. Thiamine-$^{13}C_4$

Structure of TDP and PLP



TDP
LogP: -5.80

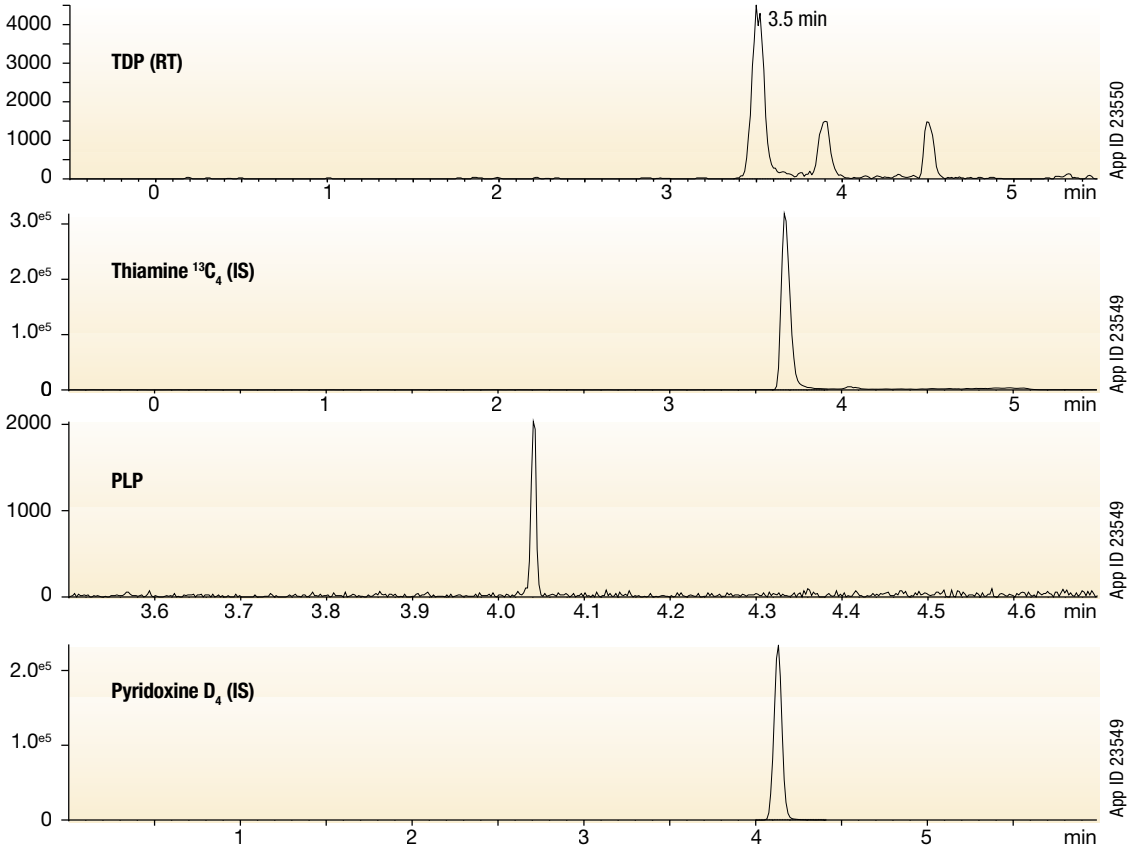


PLP
LogP: -2.09

Accuracy and precision for TDP and PLP. Five replicates at two concentrations were analyzed over two runs (n=10 for each concentration).

	TDP 100 ng/mL	PLP 100 ng/mL	TFP 200 ng/mL	PLP 200 ng/mL
Mean Conc. Found (ng/mL)	96.3	92.8	224	201
STDV	11.3	11.7	18.2	26.8
CV%	11.8	12.6	8.13	13.3
Accuracy (%)	96.3	92.8	112	101

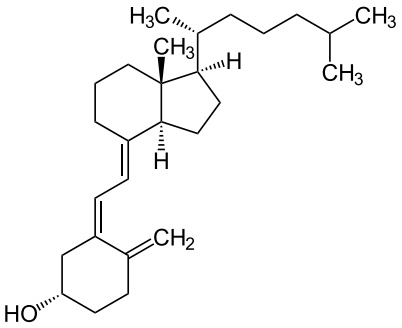
Representative Chromatogram in Whole Blood at LLOQ (20 ng/mL)



25-OH Vitamin D2 and D3 from Plasma by LC-MS/MS

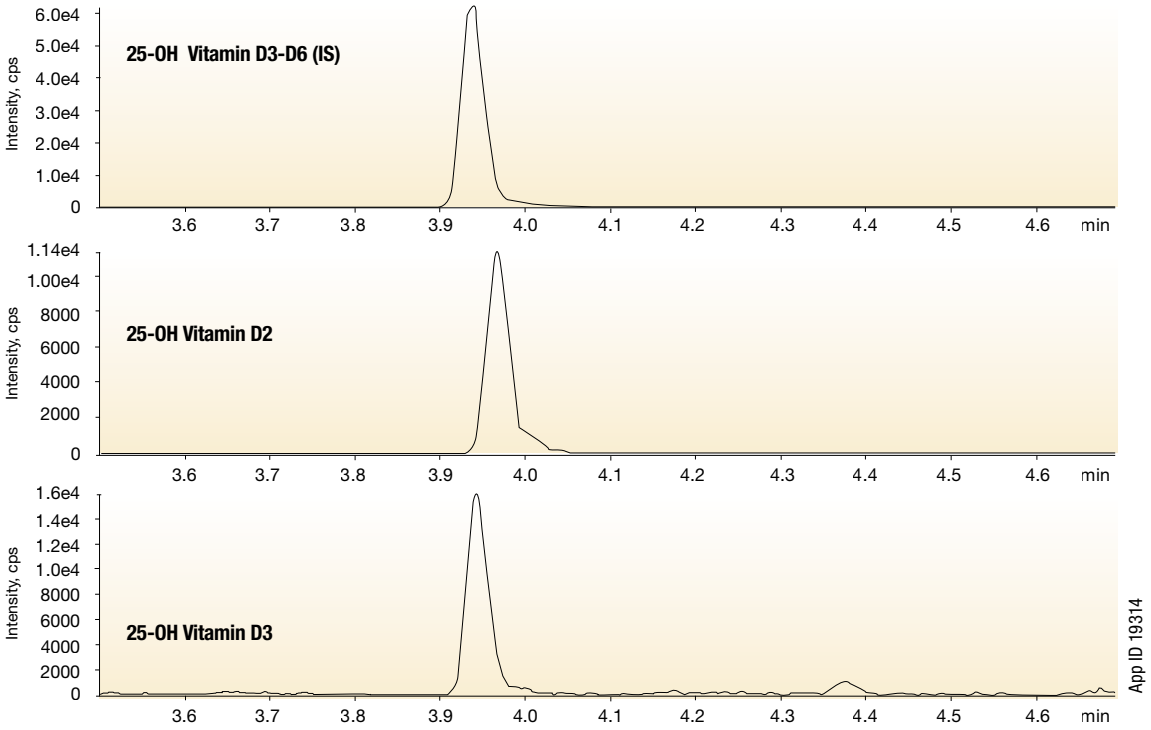
Sample Preparation

1. Add 50 µL of precipitating reagent containing internal standard to a 1.5 mL centrifuge tube.
2. Pipette 100 µL serum into the centrifuge tube.
3. Vortex 20-30 sec.
4. Inspect each tube to ensure no unmixed sample remains in the bottom of the tube. A homogenous mixture is critical. If unmixed sample remains at the bottom of the tube, dislodge by inverting and tapping, then re-vortex.
5. Centrifuge 15 min at 13,000 rpm.
6. Transfer supernatant into a sample vial without disturbing the pellet.



Vitamin D3

LC-MS/MS Conditions



Analyte	Q1	Q3
25-OH Vitamin D3-D6	389.3	263.3
25-OH Vitamin D2	395.3	209.3
25-OH Vitamin D3	383.2	257.2

Column: Kinetex™ 2.6 µm C18
Dimension: 50 x 4.6 mm
Part No.: 00B-4462-E0
Guard: SecurityGuard™ ULTRA guard cartridge system
Part No.: AJ0-8768 + AJ0-9000
Mobile Phase: A: 0.05 % Formic Acid in Water
B: 5 mM Ammonium Acetate with 0.1 % Formic Acid in Water

Gradient:	Time (min)	**%B**
	0.00	8
	0.08	8
	3.40	100
	4.80	100
	6.00	8

Flow Rate: 1 mL/min
Column Temp: 35 °C
Injection Volume: 50 µL
Detection: MS/MS (SCIEX® API 4000™)

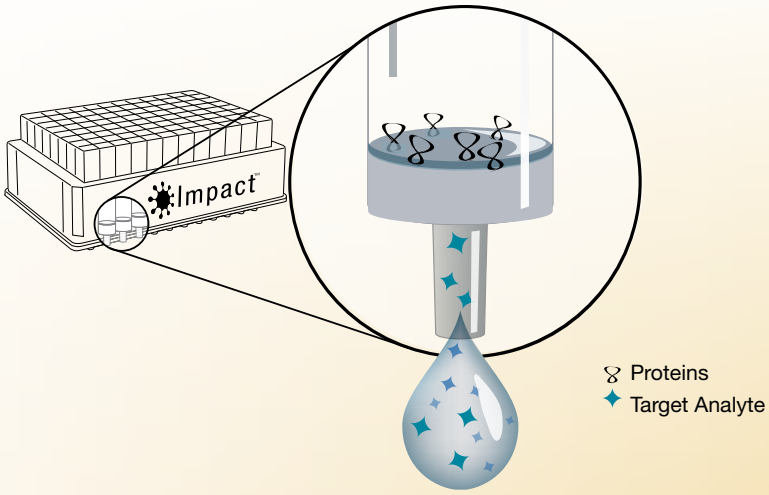
Protein Precipitation
Impact Rapid Protein Precipitation

Impact™
Rapid Protein Precipitation

Impact Rapid Protein Precipitation

1. Quickly cleanup sample by passing biological samples through the Impact filter
2. Use Impact filter to quickly clean-up biological sample.
3. Increase reproducibility with the leak-free membrane, preventing premature sample breakthrough and incomplete protein precipitation

How it Works:



Ordering Information

Impact Protein Precipitation Plates

Part No.	Description	Unit
Impact Precipitation Plates		
CE0-7565	Impact Protein Precipitation, Square Well, Filter Plate, 2 mL	2/box
CE0-7566	Impact Protein Precipitation, Square Well, Filter Plate, 2 mL, Long Drip	2/box
Impact Starter Kit for Protein Precipitation		
CE0-8201	Impact Protein Precipitation Plate (2 ea) Collection Plate 2 mL	2 ea
AH0-8199	Sealing Mat, Santoprene™	2 ea

Accessories

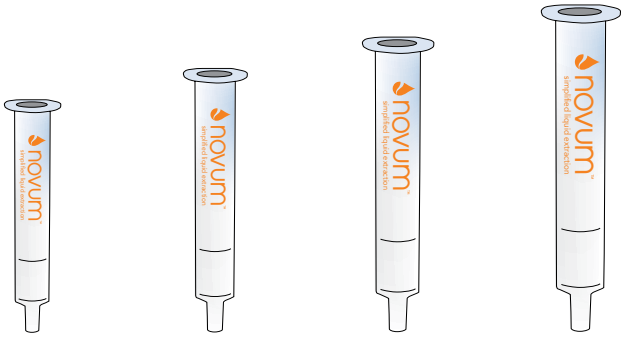
Part No.	Description	Unit
Collection Plates (deep well, polypropylene)		
AH0-7192	96-Well Collection Plate 350 µL/well	50/pk
AH0-7193	96-Well Collection Plate 1 mL/well	50/pk
AH0-7194	96-Well Collection Plate 2 mL/well	50/pk
AH0-8635	96-Well Collection Plate, 2 mL Square/Round-Conical	50/pk
AH0-8636	96-Well Collection Plate, 2 mL Round/Round, 8 mm	50/pk
AH0-7279	96-Well Collection Plate, 1 mL/well Round, 7 mm	50/pk
Sealing Mats		
AH0-8597	Sealing Mats, Pierceable, 96-Square Well, Silicone	50/pk
AH0-8598	Sealing Mats, Pre-Slit, 96-Square Well, Silicone	50/pk
AH0-8631	Sealing Mats, Pierceable, 96-Round Well 7 mm, Silicone	50/pk
AH0-8632	Sealing Mats, Pre-Slit, 96-Round Well 7 mm, Silicone	50/pk
AH0-8633	Sealing Mats, Pierceable, 96-Round Well 8 mm, Silicone	50/pk
AH0-8634	Sealing Mats, Pre-Slit, 96-Round Well 8 mm, Silicone	50/pk
AH0-7362	Sealing Tape Pad	10/pk
Vacuum Manifolds		
AH0-8950	96-Well Plate Manifold, Universal with Vacuum Gauge	ea

Novum™ Simplified Liquid Extraction (SLE)

A Variety of Formats to Fit Your Sample and Throughput Requirements

Tubes

Process samples as small as 100 µL or as large as 1 mL using Novum SLE tubes. Ideal for all types of applications including Bioanalytical, Food Safety, and Environmental.

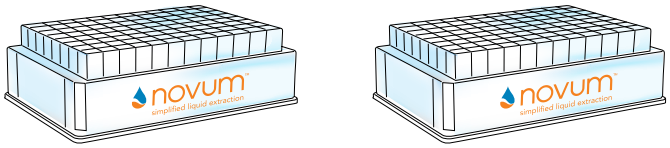


Ordering Information

Novum Simplified Liquid Extraction (SLE) Tubes				
Novum SLE Tubes	1 cc	3 cc	6 cc	12 cc
Maximum Sample Volume (before dilution)	200 µL	400 µL	1 mL	2 mL
Recommended Elution Volume	2x 600 µL	2x 900 µL	2x 2.5 mL	2x 5 mL
Part No.	8B-S138-FAK	8B-S138-5BJ	8B-S138-JCH	8B-S138-KDG
Unit	100/pk	50/pk	30/pk	20/pk

96-Well Plates

Process 96 samples at once in an easily automatable 96-well plate. Perfect for high-throughput applications.



Ordering Information

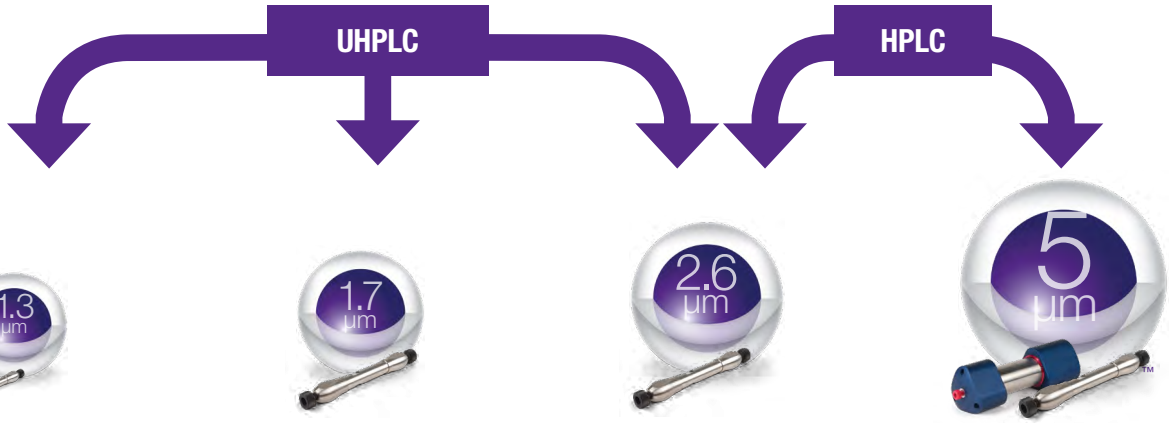
Novum Simplified Liquid Extraction (SLE) 96-Well Plates				
Novum SLE Tubes	MINI	MAX	PRO MINI	PRO MAX
Maximum Sample Volume (before dilution)	300 µL	400 µL	300 µL	400 µL
Recommended Elution Volume	1x 1 mL	2x 900 µL	1x 1 mL	2x 900 µL
Part No.	8E-S138-FGA	8E-S138-5GA	8E-S539-FGA	8E-S539-5GA
Unit	1/pk	1/pk	1/pk	1/pk

For accessories that are compatible with Novum Simplified Liquid Extraction (SLE) Products, see pp. 13

Thrive with Kinetex Core-Shell Technology!

Complete Scalable Solution from UHPLC to HPLC

KINETEX™ Core-Shell Technology



Incredible UHPLC efficiency and performance gains

20 % higher efficiency than fully porous 1.7 µm columns

Achieve sub-2 µm performance on HPLC and UHPLC systems

3 µm or better efficiencies at 5 µm pressures for HPLC methods

Column Characteristics

Kinetex Phases	Shipping Solvent†	Particle Sizes (µm)	Pore Size (Å)	Surface Area (m^2/g)	Carbon Load (%)	pH Stability	Reversed Phase	Normal Phase	HILIC	100% Aqueous Stable
Polar C18	Acetonitrile/Water (50:50)	2.6	100	200	9	1.5-8.5*	●			●
PS C18	Acetonitrile/Water (50:50)	2.6	100	200	9	1.5-8.5*	●			●
C18	Acetonitrile/Water (50:50)	1.3, 1.7, 2.6, 5	100	200	12	1.5-8.5*	●			
EVO C18	Acetonitrile/Water (45:55)	1.7, 2.6, 5	100	200	11	1-12	●			●
XB-C18	Acetonitrile/Water (50:50)	1.7, 2.6, 3.5, 5	100	200	10	1.5-8.5*	●			
C8	Acetonitrile/Water (45:55)	1.7, 2.6, 5	100	200	8	1.5-8.5*	●			
Biphenyl	Acetonitrile/Water w/ 0.1 % Formic Acid (50:50)	1.7, 2.6, 5	100	200	11	1.5-8.5*	●			●
Phenyl-Hexyl	Acetonitrile/Water (45:55)	1.7, 2.6, 5	100	200	11	1.5-8.5*	●			
F5	Acetonitrile/Water (40:60)	1.7, 2.6, 5	100	200	9	1.5-8.5*	●		●	●
HILIC	Acetonitrile/100 mM Ammonium Formate (93:7)	1.7, 2.6, 5	100	200	0	2.0-7.5		●	●	
PAH	Acetonitrile/Water (65:35)	3.5	—	—	12	1.5-8.5*	●			

† Shipping conditions may vary slightly in terms of organic to aqueous ratio, depending on column dimensions.
* pH stability under gradient conditions. pH stability is 1.5-10 under isocratic conditions.

Ordering Information (cont'd)

KINETEX Core-Shell Technology

3.5 µm Minibore and Analytical Columns (mm)						SecurityGuard™ ULTRA Cartridges‡	
Phases	50 x 2.1	150 x 2.1	100 x 4.6	150 x 4.6	250 x 4.6	3/pk	3/pk
XB-C18	—	—	00D-4744-E0	00F-4744-E0	—	—	AJ0-8768
PAH	00B-4764-AN	00F-4764-AN	00D-4764-E0	00F-4764-E0	00G-4764-E0	AJ0-9535	AJ0-9533
						for 2.1 mm ID	for 4.6 mm ID

5 µm Minibore Columns (mm)					SecurityGuard ULTRA Cartridges‡
Phases	30 x 2.1	50 x 2.1	100 x 2.1	150 x 2.1	3/pk
EVO C18	00A-4633-AN	00B-4633-AN	00D-4633-AN	00F-4633-AN	AJ0-9298
F5	—	00B-4724-AN	00D-4724-AN	00F-4724-AN	AJ0-9322
Biphenyl	00A-4627-AN	00B-4627-AN	00D-4627-AN	—	AJ0-9209
XB-C18	00A-4605-AN	00B-4605-AN	00D-4605-AN	—	AJ0-8782
C18	00A-4601-AN	00B-4601-AN	00D-4601-AN	00F-4601-AN	AJ0-8782
C8	—	00B-4608-AN	00D-4608-AN	—	AJ0-8784
Phenyl-Hexyl	—	00B-4603-AN	—	—	AJ0-8788
HILIC	—	00B-4606-AN	—	—	AJ0-8786
					for 2.1 mm ID

5 µm MidBore™ Columns (mm)					SecurityGuard ULTRA Cartridges‡
Phases	30 x 3.0	50 x 3.0	100 x 3.0	150 x 3.0	3/pk
EVO C18	00A-4633-Y0	00B-4633-Y0	00D-4633-Y0	00F-4633-Y0	AJ0-9297
F5	—	—	00D-4724-Y0	00F-4724-Y0	AJ0-9321
Biphenyl	—	00B-4627-Y0	00D-4627-Y0	00F-4627-Y0	AJ0-9208
XB-C18	—	00B-4605-Y0	00D-4605-Y0	00F-4605-Y0	AJ0-8775
C18	00A-4601-Y0	00B-4601-Y0	00D-4601-Y0	00F-4601-Y0	AJ0-8775
C8	—	00B-4608-Y0	00D-4608-Y0	—	AJ0-8777
Phenyl-Hexyl	—	00B-4603-Y0	00D-4603-Y0	—	AJ0-8781
					for 3.0 mm ID

5 µm Analytical Columns (mm)					SecurityGuard ULTRA Cartridges‡
Phases	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	3/pk
EVO C18	00B-4633-E0	00D-4633-E0	00F-4633-E0	00G-4633-E0	AJ0-9296
F5	00B-4724-E0	00D-4724-E0	00F-4724-E0	00G-4724-E0	AJ0-9320
Biphenyl	00B-4627-E0	00D-4627-E0	00F-4627-E0	00G-4627-E0	AJ0-9207
XB-C18	00B-4605-E0	00D-4605-E0	00F-4605-E0	00G-4605-E0	AJ0-8768
C18	00B-4601-E0	00D-4601-E0	00F-4601-E0	00G-4601-E0	AJ0-8768
C8	00B-4608-E0	00D-4608-E0	00F-4608-E0	00G-4608-E0	AJ0-8770
Phenyl-Hexyl	00B-4603-E0	00D-4603-E0	00F-4603-E0	00G-4603-E0	AJ0-8774
HILIC	—	—	00F-4606-E0	00G-4606-E0	AJ0-8772
					for 4.6 mm ID

5 µm Semi-Preparative Columns (mm)				SecurityGuard SemiPrep Cartridges***
Phases	100 x 10	150 x 10	250 x 10	10 x 10 /3pk
EVO C18	—	00F-4633-N0	00G-4633-N0	AJ0-9306
F5	—	—	00G-4724-N0	AJ0-9323
C18	00D-4601-N0	00F-4601-N0	00G-4601-N0	AJ0-9278
Biphenyl	—	00F-4627-N0	00G-4627-N0	AJ0-9280
XB-C18	—	00F-4605-N0	00G-4605-N0	AJ0-9278
				for 9-16 mm ID

5 µm Axia™ Packed Preparative Columns (mm)					SecurityGuard PREP Cartridges*
Phases	50 x 21.2	100 x 21.2	150 x 21.2	250 x 21.2	15 x 21.2 /ea
EVO C18	00B-4633-P0-AX	00D-4633-P0-AX	00F-4633-P0-AX	00G-4633-P0-AX	AJ0-9304
F5	—	—	00F-4724-P0-AX	00G-4724-P0-AX	AJ0-9324
Biphenyl	00B-4627-P0-AX	00D-4627-P0-AX	00F-4627-P0-AX	00G-4627-P0-AX	AJ0-9272
XB-C18	00B-4605-P0-AX	00D-4605-P0-AX	00F-4605-P0-AX	00G-4605-P0-AX	AJ0-9145
C18	00B-4601-P0-AX	00D-4601-P0-AX	00F-4601-P0-AX	00G-4601-P0-AX	AJ0-9145
C8	00B-4608-P0-AX	00D-4608-P0-AX	00F-4608-P0-AX	00G-4608-P0-AX	AJ0-9205
Phenyl-Hexyl	00B-4603-P0-AX	00D-4603-P0-AX	00F-4603-P0-AX	00G-4603-P0-AX	AJ0-9147
HILIC	—	00D-4606-P0-AX	00F-4606-P0-AX	00G-4606-P0-AX	AJ0-9277
					for 18-29 mm ID

5 µm Axia Packed Preparative Columns (mm)					SecurityGuard PREP Cartridges**
Phases	50 x 30	100 x 30	150 x 30	250 x 30	15 x 30 /ea
EVO C18	00B-4633-U0-AX	00D-4633-U0-AX	00F-4633-U0-AX	00G-4633-U0-AX	AJ0-9305
F5	00B-4724-U0-AX	00D-4724-U0-AX	00F-4724-U0-AX	—	AJ0-9325
Biphenyl	—	—	00F-4627-U0-AX	00G-4627-U0-AX	AJ0-9273
XB-C18	00B-4605-U0-AX	00D-4605-U0-AX	00F-4605-U0-AX	00G-4605-U0-AX	AJ0-9204
C18	00B-4601-U0-AX	00D-4601-U0-AX	00F-4601-U0-AX	00G-4601-U0-AX	AJ0-9204
C8	00B-4608-U0-AX	00D-4608-U0-AX	00F-4608-U0-AX	00G-4608-U0-AX	AJ0-9217
Phenyl-Hexyl	—	—	00F-4603-U0-AX	00G-4603-U0-AX	AJ0-9216
HILIC	—	—	00D-4606-U0-AX	—	—
					for 30-49 mm ID

‡ SecurityGuard ULTRA Cartridges require holder, Part No.: AJ0-9000

* PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8223

** PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8277

*** SemiPrep SecurityGuard Cartridges require holder, Part No.: AJ0-9281

Ordering Information (cont'd)

KINETEX Core-Shell Technology

2.6 µm Micro LC Columns (mm)						
Phases	**30 x 0.3**	**50 x 0.3**	**100 x 0.3**	**150 x 0.3**	**50 x 0.5**	**150 x 0.5**
Biphenyl	—	00B-4622-AC	—	00F-4622-AC	00B-4622-AF	—
C18	00A-4462-AC	00B-4462-AC	—	00F-4462-AC	00B-4462-AF	—
EVO C18	—	00B-4725-AC	—	00F-4725-AC	00B-4725-AF	—
F5	—	00B-4723-AC	00D-4723-AC	00F-4723-AC	00B-4723-AF	—
XB-C18	00A-4496-AC	00B-4496-AC	00D-4496-AC	00F-4496-AC	00B-4496-AF	00F-4496-AF

2.6 µm Minibore Columns (mm)						SecurityGuard ULTRA Cartridges‡
Phases	**30 x 2.1**	**50 x 2.1**	**75 x 2.1**	**100 x 2.1**	**150 x 2.1**	**3/pk**
EVO C18	00A-4725-AN	00B-4725-AN	—	00D-4725-AN	00F-4725-AN	AJ0-9298
PS C18	00A-4780-AN	00B-4780-AN	—	00D-4780-AN	00F-4780-AN	AJ0-8951
Polar C18	00A-4759-AN	00B-4759-AN	—	00D-4759-AN	00F-4759-AN	AJ0-9532
F5	00A-4723-AN	00B-4723-AN	—	00D-4723-AN	00F-4723-AN	AJ0-9322
Biphenyl	00A-4622-AN	00B-4622-AN	—	00D-4622-AN	00F-4622-AN	AJ0-9209
XB-C18	00A-4496-AN	00B-4496-AN	00C-4496-AN	00D-4496-AN	00F-4496-AN	AJ0-8782
C18	00A-4462-AN	00B-4462-AN	00C-4462-AN	00D-4462-AN	00F-4462-AN	AJ0-8782
C8	00A-4497-AN	00B-4497-AN	00C-4497-AN	00D-4497-AN	00F-4497-AN	AJ0-8784
HILIC	00A-4461-AN	00B-4461-AN	00C-4461-AN	00D-4461-AN	00F-4461-AN	AJ0-8786
Phenyl-Hexyl	00A-4495-AN	00B-4495-AN	00C-4495-AN	00D-4495-AN	00F-4495-AN	AJ0-8788

for 2.1 mm ID

2.6 µm MidBore™ Columns (mm)						SecurityGuard ULTRA Cartridges‡
Phases	**30 x 3.0**	**50 x 3.0**	**75 x 3.0**	**100 x 3.0**	**150 x 3.0**	**3/pk**
EVO C18	00A-4725-Y0	00B-4725-Y0	—	00D-4725-Y0	00F-4725-Y0	AJ0-9297
PS C18	00B-4780-Y0	00D-4780-Y0	—	00D-4780-Y0	00F-4780-Y0	AJ0-8950
Polar C18	—	00B-4759-Y0	—	00D-4759-Y0	00F-4759-Y0	AJ0-9531
F5	—	00B-4723-Y0	—	00D-4723-Y0	00F-4723-Y0	AJ0-9321
Biphenyl	—	00B-4622-Y0	—	00D-4622-Y0	00F-4622-Y0	AJ0-9208
XB-C18	00A-4496-Y0	00B-4496-Y0	00C-4496-Y0	00D-4496-Y0	00F-4496-Y0	AJ0-8775
C18	00A-4462-Y0	00B-4462-Y0	00C-4462-Y0	00D-4462-Y0	00F-4462-Y0	AJ0-8775
C8	00A-4497-Y0	00B-4497-Y0	00C-4497-Y0	00D-4497-Y0	00F-4497-Y0	AJ0-8777
HILIC	00A-4461-Y0	—	—	00D-4461-Y0	00F-4461-Y0	AJ0-8779
Phenyl-Hexyl	—	00B-4495-Y0	—	00D-4495-Y0	00F-4495-Y0	AJ0-8781

for 3.0 mm ID

2.6 µm Analytical Columns (mm)							SecurityGuard ULTRA Cartridges‡
Phases	**30 x 4.6**	**50 x 4.6**	**75 x 4.6**	**100 x 4.6**	**150 x 4.6**	**250 x 4.6**	**3/pk**
EVO C18	00A-4725-E0	00B-4725-E0	—	00D-4725-E0	00F-4725-E0	00G-4725-E0	AJ0-9296
PS C18	00A-4780-E0	00B-4780-E0	—	00D-4780-E0	00F-4780-E0	00G-4780-E0	AJ0-8949
Polar C18	00A-4759-E0	00B-4759-E0	—	00D-4759-E0	00F-4759-E0	—	AJ0-9532
F5	00A-4723-E0	00B-4723-E0	—	00D-4723-E0	00F-4723-E0	—	AJ0-9320
Biphenyl	—	00B-4622-E0	—	00D-4622-E0	00F-4622-E0	—	AJ0-9207
XB-C18	—	00B-4496-E0	00C-4496-E0	00D-4496-E0	00F-4496-E0	—	AJ0-8768
C18	00A-4462-E0	00B-4462-E0	00C-4462-E0	00D-4462-E0	00F-4462-E0	—	AJ0-8768
C8	—	00B-4497-E0	00C-4497-E0	00D-4497-E0	00F-4497-E0	—	AJ0-8770
HILIC	—	00B-4461-E0	00C-4461-E0	00D-4461-E0	00F-4461-E0	—	AJ0-8772
Phenyl-Hexyl	—	00B-4495-E0	00C-4495-E0	00D-4495-E0	00F-4495-E0	—	AJ0-8774

for 4.6 mm ID

1.7 µm Minibore Columns (mm)					SecurityGuard™ ULTRA Cartridges‡
Phases	**30 x 2.1**	**50 x 2.1**	**100 x 2.1**	**150 x 2.1**	**3/pk**
EVO C18	—	00B-4726-AN	00D-4726-AN	00F-4726-AN	AJ0-9298
F5	—	00B-4722-AN	00D-4722-AN	00F-4722-AN	AJ0-9322
Biphenyl	00A-4628-AN	00B-4628-AN	00D-4628-AN	00F-4628-AN	AJ0-9209
XB-C18	00A-4498-AN	00B-4498-AN	00D-4498-AN	00F-4498-AN	AJ0-8782
C18	00A-4475-AN	00B-4475-AN	00D-4475-AN	00F-4475-AN	AJ0-8782
C8	00A-4499-AN	00B-4499-AN	00D-4499-AN	00F-4499-AN	AJ0-8784
HILIC	00A-4474-AN	00B-4474-AN	00D-4474-AN	—	AJ0-8786
Phenyl-Hexyl	—	00B-4500-AN	00D-4500-AN	00F-4500-AN	AJ0-8788

for 2.1 mm ID

2.6 µm Microbore Columns (mm)			
Phases	**50 x 1.0**	**100 x 1.0**	**150 x 1.0**
C18	00B-4462-A0	—	—
XB-C18	00B-4496-A0	00D-4496-A0	00F-4496-A0

1.7 µm MidBore Columns (mm)				SecurityGuard ULTRA Cartridges‡
Phases	**30 x 3.0**	**50 x 3.0**	**100 x 3.0**	**3/pk**
XB-C18	00A-4498-Y0	00B-4498-Y0	00D-4498-Y0	AJ0-8775
C18	—	00B-4475-Y0	00D-4475-Y0	AJ0-8775
C8	00A-4499-Y0	00B-4499-Y0	00D-4499-Y0	AJ0-8777
Phenyl	—	—	00D-4500-Y0	AJ0-8781
HILIC	—	00B-4474-Y0	—	AJ0-8779

for 3.0 mm ID

1.3 µm Minibore Columns (mm)		
Phases	**30 x 2.1**	**50 x 2.1**
C18	00A-4515-AN	00B-4515-AN

1.7 µm Microbore Columns (mm)			
Phases	**50 x 1.0**	**100 x 1.0**	**150 x 1.0**
EVO C18	00B-4726-A0	00D-4726-A0	00F-4726-A0
Biphenyl	00B-4628-A0	00D-4628-A0	—

‡ SecurityGuard ULTRA Cartridges require holder, Part No.: AJ0-9000

Gemini™ pH Flexible LC

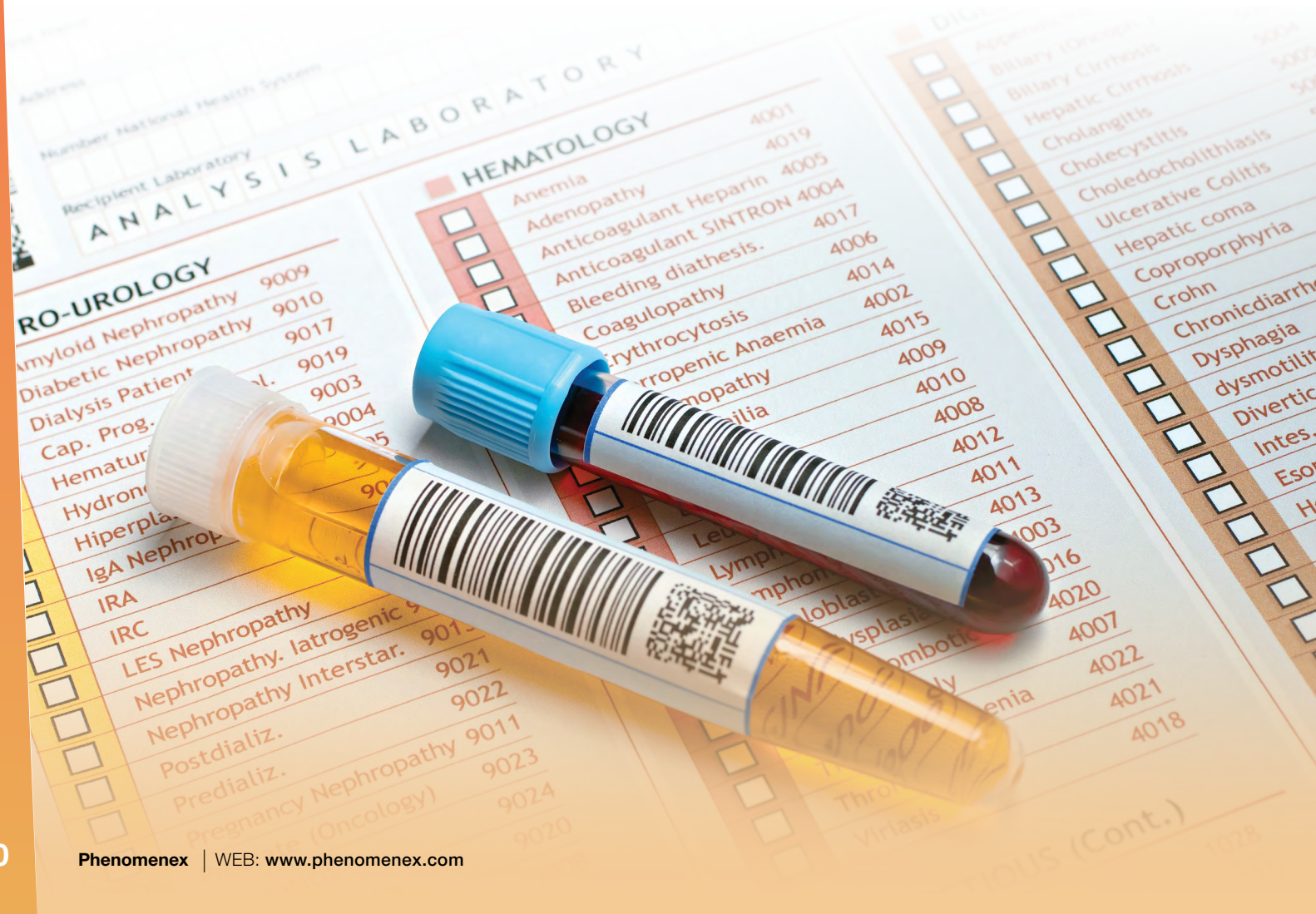
U.S. Patent Nos. 7, 563, 367 and 8, 658, 038 and foreign counterparts.

Setting the Standard for pH Method Development

Rugged reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations.

- Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity
- Expect longer column lifetime with patented TWIN-NX™ technology
- For analytical and preparative separations of basic and acidic compounds

Phase	Description	USP Classification
NX-C18	The most rugged Gemini column, offering 5 times the durability of previous generation hybrid columns	L1
C6-Phenyl	A low bleed phenyl phase. For UV and MS detection, which offers an aromatic selectivity complementary to C18 phases	L11
C18	Selectivity, high structural integrity and increased loadability for preparative and purification applications in pre-packed columns and bulk media	L1



Gemini™ Ordering Information

3µm Microbore, Minibore and MidBore™ Columns (mm)							SecurityGuard™ Cartridges (mm)			
Phases	50 x 1.0	20 x 2.0	30 x 2.0	50 x 2.0	100 x 2.0	150 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	4 x 2.0*
C18	00B-4439-A0	00M-4439-B0	00A-4439-B0	00B-4439-B0	00D-4439-B0	00F-4439-B0	00B-4439-Y0	00D-4439-Y0	00F-4439-Y0	AJ0-7596
C6-Phenyl	—	—	—	00B-4443-B0	00D-4443-B0	00F-4443-B0	00B-4443-Y0	00D-4443-Y0	00F-4443-Y0	AJ0-7914
NX-C18	00B-4453-A0	00M-4453-B0	00A-4453-B0	00B-4453-B0	00D-4453-B0	00F-4453-B0	00B-4453-Y0	00D-4453-Y0	00F-4453-Y0	AJ0-8367
										for 2.0-3.0 mm ID

3µm Analytical Columns (mm)						SecurityGuard Cartridges (mm)	
Phases	20 x 4.0	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
C18	00M-4439-D0	00A-4439-E0	00B-4439-E0	00D-4439-E0	00F-4439-E0	00G-4439-E0	AJ0-7597
C6-Phenyl	00A-4443-E0	00A-4443-E0	00B-4443-E0	00D-4443-E0	00F-4443-E0	00G-4443-E0	AJ0-7915
NX-C18	—	00A-4453-E0	00B-4453-E0	00D-4453-E0	00F-4453-E0	00G-4453-E0	AJ0-8368
							for 3.2-8.0 mm ID

5µm Minibore and MidBore Columns (mm)								SecurityGuard Cartridges (mm)	
Phases	30 x 2.0	50 x 2.0	150 x 2.0	250 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	250 x 3.0	4 x 2.0*
C18	00A-4435-B0	00B-4435-B0	00F-4435-B0	00G-4435-B0	00B-4435-Y0	00D-4435-Y0	00F-4435-Y0	00G-4435-Y0	AJ0-7596
C6-Phenyl	—	00B-4444-B0	00F-4444-B0	—	00B-4444-Y0	—	00F-4444-Y0	00G-4444-Y0	AJ0-7914
NX-C18	00A-4454-B0	00B-4454-B0	00F-4454-B0	—	00B-4454-Y0	00D-4454-Y0	00F-4454-Y0	00G-4454-Y0	AJ0-8367
									for 2.0-3.0 mm ID

5µm Analytical Columns (mm)						SecurityGuard Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
C18	00A-4435-E0	00B-4435-E0	00D-4435-E0	00F-4435-E0	00G-4435-E0	AJ0-7597
C6-Phenyl	—	00B-4444-E0	00D-4444-E0	00F-4444-E0	00G-4444-E0	AJ0-7915
NX-C18	—	00B-4454-E0	00D-4454-E0	00F-4454-E0	00G-4454-E0	AJ0-8368
						for 3.2-8.0 mm ID

*SecurityGuard Analytical Cartridges require holder, Part No.: KJ0-4282

Vitamin Testing

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