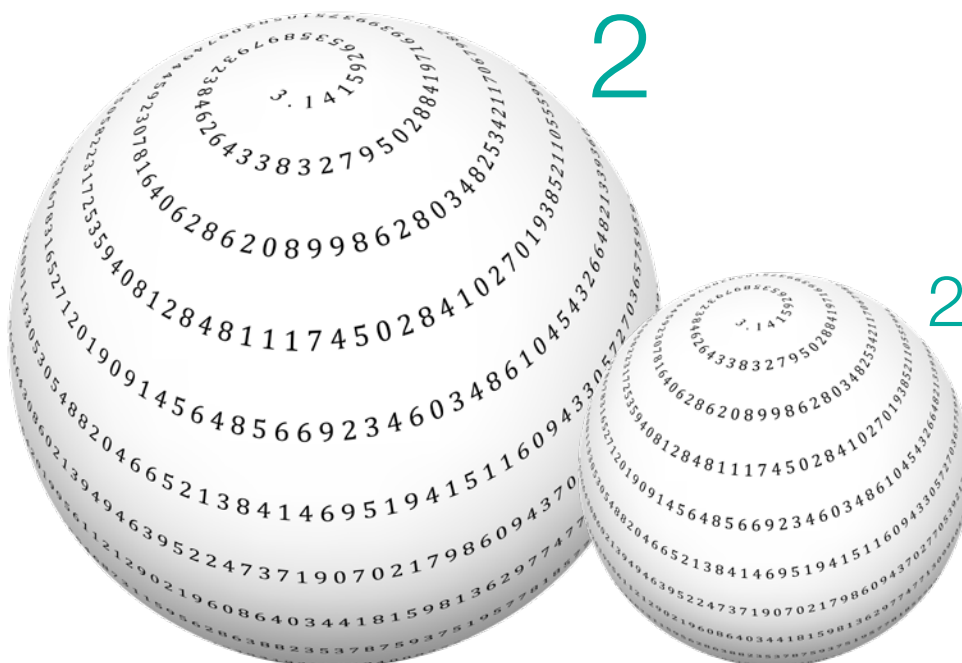


MACHEREY-NAGEL

NUCLEODUR® π^2

Cromatografía



Ahora disponible con un tamaño de partículas de 5 μm y 3 μm

- Fase hidrófoba con selectividad alternativa frente a la de las modificaciones clásicas de C_{18}
- Interacciones π - π potenciadas en HPLC
- Apto para fases móviles 100 % acuosas

MACHEREY-NAGEL

www.mn-net.com



Características principales

- Fase hidrófoba con selectividad alternativa frente a la de las modificaciones clásicas de C₁₈
- Modo de separación basado en dos mecanismos de retención:
Interacciones π - π e interacciones hidrófobas
- Mayor retención de sustancias aromáticas e insaturadas
- Excelente rendimiento en condiciones altamente acuosas
- Marcada selectividad ortogonal en acetonitrilo y especialmente en metanol

Aplicaciones recomendadas

- Separaciones analíticas sofisticadas en general
- Compuestos aromáticos e insaturados
- Compuestos polares
- Productos farmacéuticos
- Antibióticos
- Esteroides
- Plaguicidas

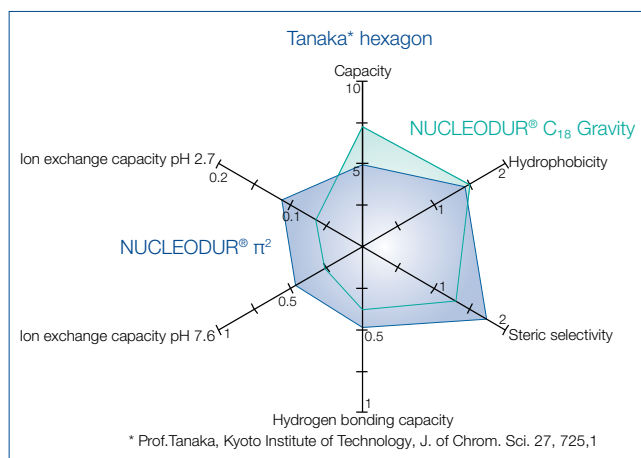
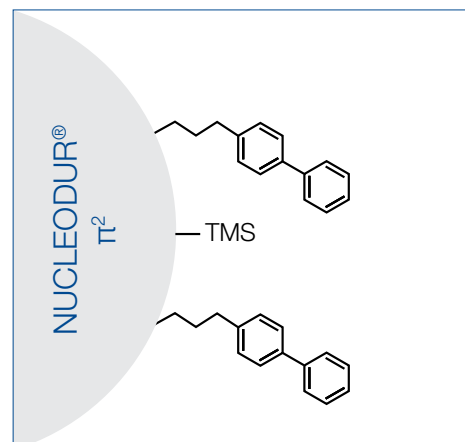
USP L11

Fases similares: Pinnacle® DB Biphenyl, Ultra Biphenyl

Datos técnicos

Modificación de bifenilpropilo con multiterminación

Estabilidad a pH:	3–10
Tamaño de partículas:	3 μ m y 5 μ m
Tamaño de poro:	110 Å
Superficie específica:	340 m ² /g
Contenido de carbono:	17 %



Stability under aqueous conditions

MN Appl. No. 127900

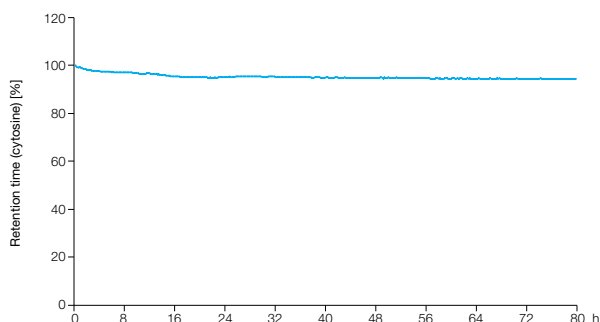
Chromatographic conditions

Column:	125/4 NUCLEODUR® π^2 , 5 μ m
MN REF:	760623.40
Eluent:	20 mmol/L potassium dihydrogen phosphate in water (adjusted to pH 3.1 by 85 % phosphoric acid)
Flow rate:	1 mL/min
Temperature:	20 °C
Detection:	UV, 220 nm
Injection:	1 μ L cytosine in methanol–buffer (1:1, v/v)

Mayor estabilidad

Excelente rendimiento con una fase móvil 100 % acuosa.


Chromatogram



Steroids

MN Appl. No. 127910

Chromatographic conditions

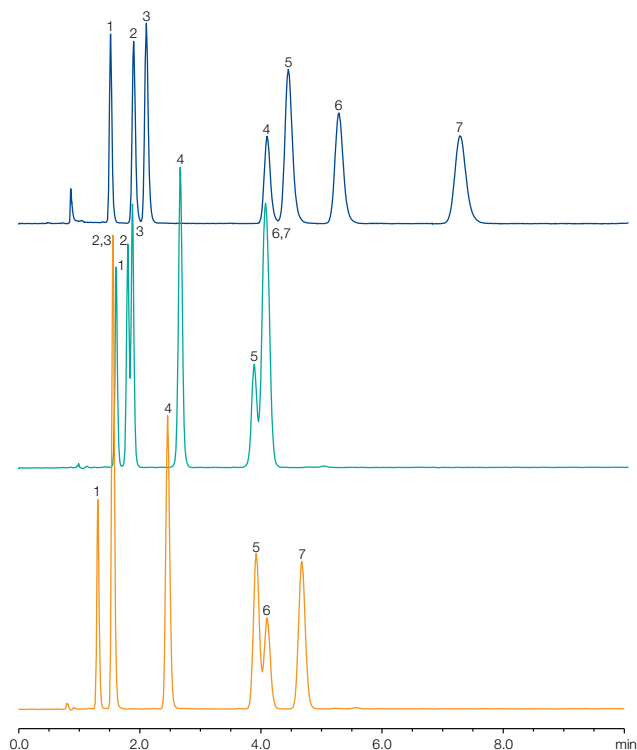
 Column: 125/4 each
 NUCLEODUR® π², 5 μm
 NUCLEODUR® Phenyl-Hexyl, 5 μm
 NUCLEODUR® C₁₈ Gravity, 5 μm
 MN REF: 760623.40 (NUCLEODUR® π²)
 Eluent: acetonitrile–water (45:55, v/v)
 Flow rate: 1 mL/min
 Temperature: 25 °C
 Detection: UV, 230 nm
 Injection: 1 μL

Analyte	Peak No.
1. Estriol	1
2. Hydrocortisone	2
3. Prednisone	3
4. β-Estradiol	4
5. Corticosterone	5
6. Cortisonacetate	6
7. Testosterone	7

Selectividad alternativa

Solo se logró una separación completa en NUCLEODUR® π².


Chromatograms



Amines

MN Appl. No. 128580

Chromatographic conditions

 Column: EC 150/2 NUCLEODUR® π², 5 μm
 MN REF: 760624.20
 Eluent A: 0.02 % formic acid in water
 Eluent B: 0.02 % formic acid in acetonitrile
 Gradient: in 10 min from 5 % to 85 % B, hold for 10.0 min,
 in 1.0 min to 5 % B, hold 5 % B for 9.0 min
 Flow rate: 0.3 mL/min
 Temperature: 40 °C
 Detection: MS, SMRM
 Injection: 5 μL

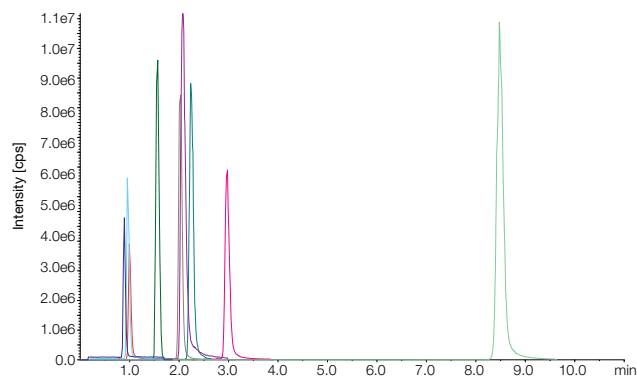
Concentration

300 ng/mL for each analyte

MRM transitions

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Trimethylamine	0.92	60.0	44.0	45.0
2-(Diethyl-amino)-ethanol	0.96	118.0	100.1	72.0
Pyridine	1.08	80.0	53.0	
Aniline	1.49	93.9	77.1	
p-Toluidine	2.11	107.9	93.1	65.1

Chromatogram




Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
N,N-Dimethyl-benzylamine	2.22	136.0	91.0	65.0
Diisobutylamine	2.37	136.0	91.0	65.0
Dibutylamine	3.09	130.1	57.0	41.0
Dibenzylamine	8.87	198.0	91.1	65.0

Anthocyanins in blueberry juice

MN Appl. No. 128260

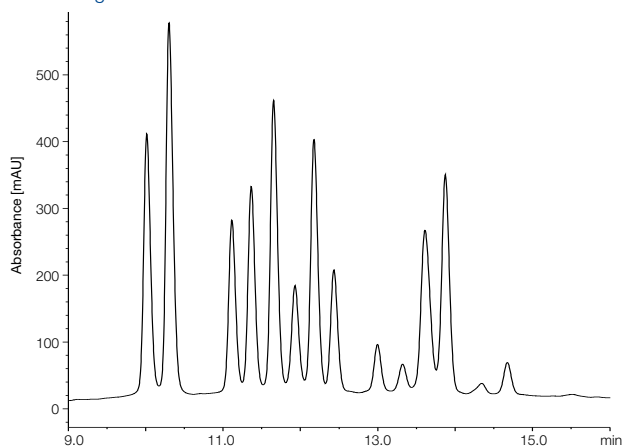
Chromatographic conditions

	Column:	EC 250/4 NUCLEODUR® π ² , 5 μm
	MN REF:	760625.40
	Eluent A:	5 % formic acid in water
	Eluent B:	methanol
	Gradient:	5–95 % B in 30 min, hold for 10 min, back to 5 % B in 1 min, hold for 9 min
	Flow rate:	0.75 mL/min
	Temperature:	65 °C
	Detection:	Vis, 520 nm
	Injection:	20 μL

Concentration

Blueberry juice was diluted 10 times with eluent A, following filtration with CHROMAFIL® Xtra PET-20/13 (MN REF 729222)

Chromatogram



MRM transitions


Analyte	RT [min]
Delphinidin 3-galactoside	10.5
Delphinidin 3-glucoside	10.8
Delphinidin 3-arabinoside	11.6
Cyanidin 3-galactoside	11.9
Cyanidin 3-glucoside	12.2
Petunidin 3-galactoside	12.5
Petunidin 3-glucoside	12.7

Analyte	RT [min]
Cyanidin 3-arabinoside	13.0
Petunidin 3-arabinoside	13.6
Peonidin 3-galactoside	13.9
Malvidin 3-galactoside + Peonidin 3-glucoside	14.2
Malvidin 3-glucoside	14.4
Malvidin 3-arabinoside	14.9

Triarylmethane dyes

MN Appl. No. 128430

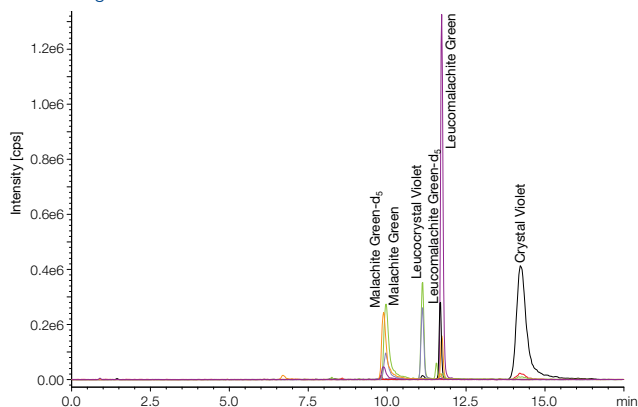
Chromatographic conditions

	Column:	EC 100/3 NUCLEODUR® π ² , 3 μm
	MN REF:	760636.30
	Eluent A:	5 mmol/L ammonium acetate + 0.1 % formic acid in water
	Eluent B:	acetonitrile
	Gradient:	in 10 min from 20 % to 85 % B, hold for 5.0 min, in 1.0 min to 20 % B, hold 20 % B for 5.0 min
	Flow rate:	0.4 mL/min
	Temperature:	25 °C
	Detection:	MS, MRM
	Injection:	5 μL

Concentration

0.25 ng/mL in eluent A for each analyte

Chromatogram



MRM transitions


Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Malachite Green	10.1	328.9	313.1	207.9
Malachite Green-d ₅	10.1	333.9	318.3	213.1
Leucocystal Violet	11.2	373.9	358.0	238.2
Leucomalachite Green-d ₅	11.7	335.9	321.1	243.1

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Leucomalachite Green	11.8	330.9	316.2	239.1
Crystal Violet	14.8	372.2	356.3	251.1

Isothiazolinones

MN Appl. No. 128440

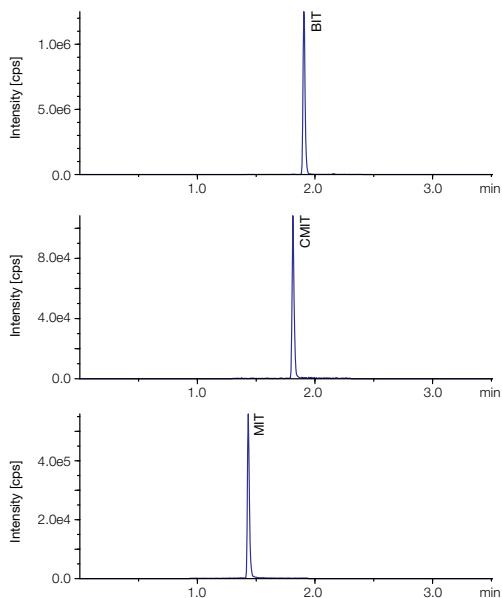
Chromatographic conditions

	Column: EC 50/4.6 NUCLEODUR® π ² , 3 μm
	MN REF: 760633.46
	Eluent A: 0.1 % formic acid in water
	Eluent B: acetonitrile – methanol (80:20, v/v)
	Gradient: in 0.5 min from 0 % to 5.0 % B, in 2.0 min from 5 % to 95 % B, hold 95 % B for 0.5 min, in 0.1 min to 0 % B, hold 0 % B for 1.9 min
	Flow rate: 1.3 mL/min
	Temperature: 30 °C
	Detection: MS, MRM
	Injection: 5 μL

Concentration

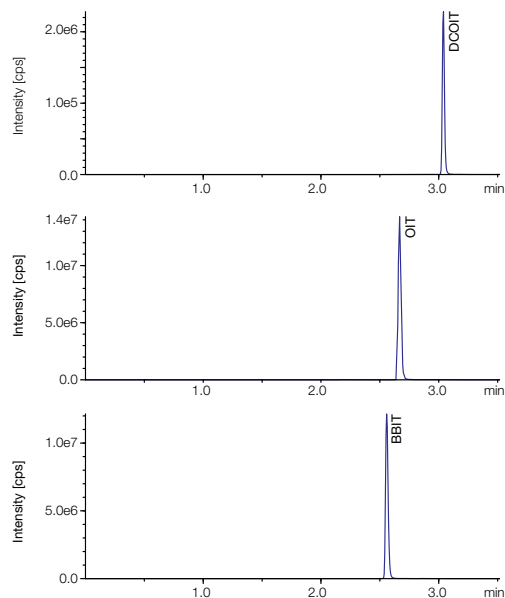
100 ng/mL in water for each analyte

Chromatograms



MRM transitions


Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
2-Methyl-4-isothiazolin-3-one (MIT)	1.43	116.1	53.1	45.0
5-Chloro-2-methyl-4-isothiazolin-3-one (CMIT)	1.81	149.9	87.0	135.0
1,2-Benzisothiazol-3(2H)-one (BIT)	1.91	152.0	109.0	134.1
2-Butyl-1,2-benzisothiazolin-3-one (BBIT)	2.52	208.1	152.0	109.0
2-Octyl-4-isothiazolin-3-one (OIT)	2.67	214.2	102.0	43.1
4,5-Dichloro-2-octyl-isothiazolinone (DCOIT)	3.04	282.1	169.8	73.0



Drug analytes

MN Appl. No. 128380

Chromatographic conditions

	Column: EC 50/4.6 NUCLEODUR® π ² , 3 μm MN REF: 760633.46 Eluent A: 0.1 % formic acid in water Eluent B: 0.1 % formic acid in methanol Gradient: in 4.5 min from 5 % to 90 % B, hold for 0.5 min, in 0.5 min to 5 % B, hold 5 % B for 4.5 min Flow rate: 1.3 mL/min Temperature: 30 °C Detection: MS, MRM Injection: 5 μL
---	--

Concentration

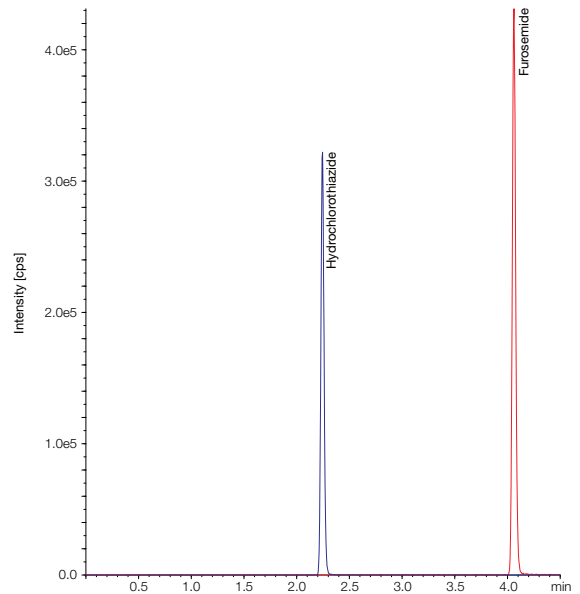
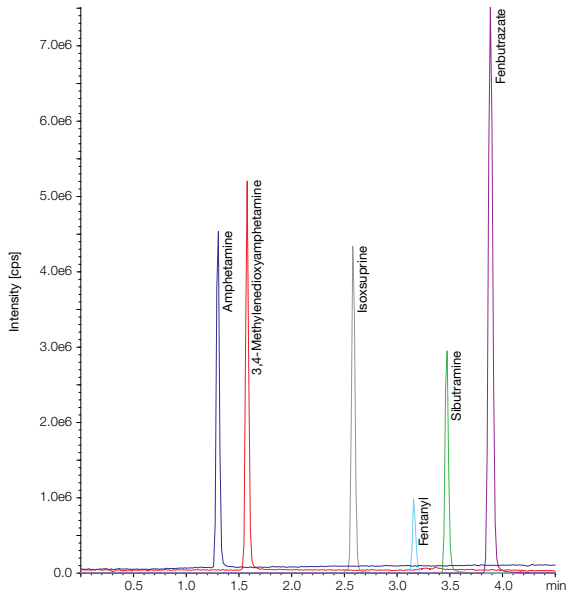
50 ng/mL each in water for each analyte

MRM transitions

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Amphetamine	1.30	136.0	91.1	108.9
3,4-Methylenedioxyamphetamine	1.58	180.0	163.1	105.0
Isoxsuprine	2.58	303.0	285.1	77.1
Fentanyl	3.16	337.0	304.9	105.1
Sibutramine	3.47	280.0	125.0	139.1
Fenbutrazate	3.89	368.2	191.1	91.1

Analyte	RT [min]	[M-H] ⁻	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Hydrochlorothiazide	2.24	295.9	268.7	98.9
Furosemide	4.06	329.0	283.2	255.2

Chromatograms



Nitrosamines

MN Appl. No. 128360

Chromatographic conditions

- Column: EC 100/2 NUCLEODUR® π², 3 μm
- MN REF: 760636.20
- Eluent A: 0.1 % formic acid in water
- Eluent B: 0.1 % formic acid in methanol
- Gradient: hold 2.5 % B for 1.0 min, in 1 min from 2.5 % to 50 % B, hold for 1.0 min, in 0.5 min to 97.5 % B, hold for 2.5 min, in 0.1 min to 2.5 % B, hold for 3.0 min
- Flow rate: 0.3 mL/min
- Temperature: 40 °C
- Detection: MS, MRM
- Injection: 20 μL

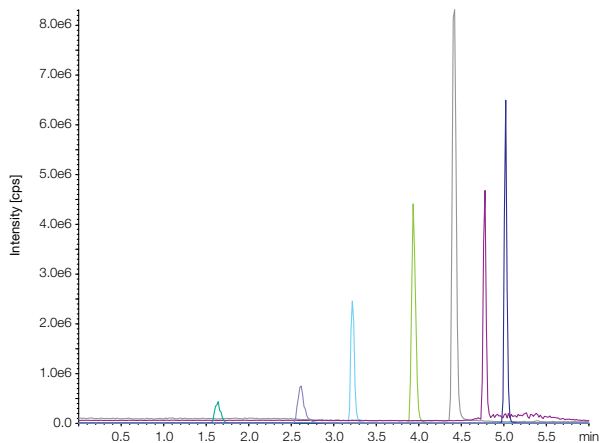
Concentration

100 ng/mL in water for each analyte

MRM transitions

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
N-Nitroso-diethanolamine	1.64	135.1	74.0	104.1
N-Nitroso-dimethylamine	2.61	75.1	58.0	
N-Nitroso-morpholine	3.22	117.0	45.0	86.0
N-Nitroso-diethylamine	3.94	103.1	75.1	47.0

Chromatogram



Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
N-Nitroso-piperidine	4.41	115.1	69.1	41.0
N-Nitroso-dipropylamine	4.77	131.1	89.2	43.0
N-Nitroso-dibutylamine	5.02	159.2	57.1	103.2

THC and its metabolites

MN Appl. No. 128640

Chromatographic conditions

- Column: EC 50/4.6 NUCLEODUR® π², 3 μm
- MN REF: 760633.46
- Eluent A: 0.1 % formic acid in water
- Eluent B: 0.1 % formic acid in acetonitrile
- Gradient: in 2.5 min from 0 % to 90 % B, hold for 0.5 min, in 0.1 min to 0 % B, hold 0 % B for 2.9 min
- Flow rate: 1.3 mL/min
- Temperature: 40 °C
- Detection: MS, SMRM
- Injection: 5 μL

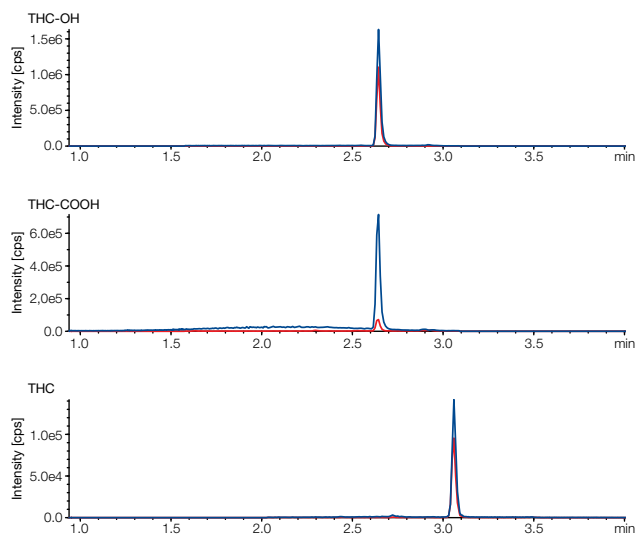
Concentration

50 ng/mL in water for each analyte

MRM transitions

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
THC-OH	2.64	331.2	99.1	43.1
THC-COOH	2.64	345.2	327.2	299.2
THC	3.06	315.2	193.1	123.1

Chromatograms




Q₁ (Quantifier) — blue line
Q₂ (Qualifier) — red line


Pesticides

MN Appl. No. 128650

Chromatographic conditions


Column: EC 50/4.6 NUCLEODUR® π², 3 μm
MN REF: 760633.46
Eluent A: 0.1 % formic acid in water
Eluent B: 0.1 % formic acid in methanol
Gradient: in 5 min from 5 % to 100 % B, hold for 1.0 min. in 0.1 min to 5 % B, hold 5 % B for 3.9 min
Flow rate: 1.3 mL/min
Temperature: 30 °C
Detection: MS, SMRM
Injection: 5 μL

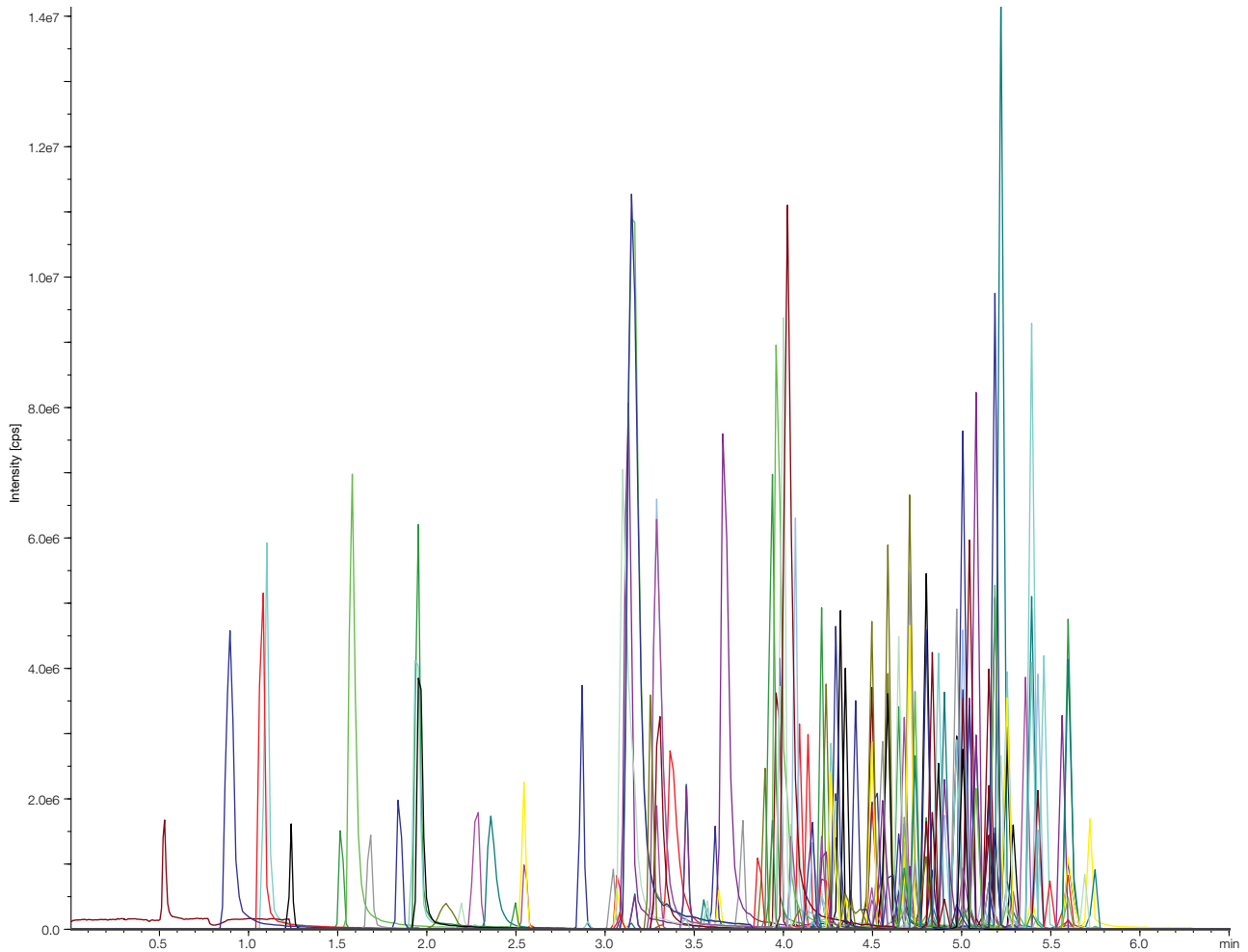
Análisis rápido


 Análisis LC/MS de más de 170 plaguicidas en menos de 6 minutos en NUCLEODUR® π², 3 μm.

Concentration

50 ng/mL in water for each analyte

Chromatogram



MRM transitions

Analyte	RT [min]
Cyromazine	0.72
Methamidophos	1.27
Aminocarb	1.40
Acephate	1.55

Analyte	RT [min]
Pymetrozine	1.79
Omethoate	1.88
Mexacarbate	2.20
Thiabendazole	2.26

Continued on page 9

Continued from page 8

Analyte	RT [min]
Fuberidazole	2.27
Aldicarb sulfone	2.35
Nitenpyram	2.35
Monocrotophos	2.55
Flonicamid	2.58
Oxamyl	2.58
Methomyl	2.67
Ethirimol	2.70
Dicrotophos	2.92
Fenuron	3.10
3-Hydroxycarbofuran	3.13
Mevinphos (mix of isomers)	3.20
Thiamethoxam	3.25
Clothianidin	3.26
Prometon	3.26
Dioxacarb	3.30
Secbumeton	3.30
Terbumeton	3.30
Vamidothion	3.34
Dimethoate	3.39
Pirimicarb	3.41
Simetryn	3.43
Imazalil	3.55
Spiroxamine (mix of isomers)	3.62
Aldicarb	3.65
Butocarboxim	3.66
Carbetamide	3.67
Ametryn	3.75
Fenpropimorph	3.75
Imidacloprid	3.79
Propoxur	3.94
Bendiocarb	3.96
Acetamiprid	4.00
Thidiazuron	4.00
Methoprotryne	4.01
Prometryn	4.03
Tebuthiuron	4.04
Carbofuran	4.06
Fluometuron	4.06
Terbutryn	4.09
Carbaryl	4.12
Propham	4.13
Isoprocarb	4.15
Pyracarbolid	4.16
Metribuzin	4.17

Analyte	RT [min]
Monolinuron	4.18
Chlorotoluron	4.19
Isoproturon	4.26
Ethiofencarb	4.27
Cycluron	4.33
Forchlorfenuron	4.34
Hydramethylnon	4.35
Pyrimethanil	4.35
Carboxin	4.36
Fenobucarb	4.39
Oxadixyl	4.39
Isocarbophos	4.42
Flutriafol	4.43
Siduron	4.45
Diuron	4.46
Thiacloprid	4.48
Fludioxinil	4.53
Promecarb	4.53
Spirotetramat	4.54
Halofenozide	4.55
Tricyclazole	4.55
Diethofencarb	4.56
Emamectin B1a benzoate	4.57
Spinosad (Spinosyn A)	4.57
Linuron	4.60
Metobromuron	4.60
Iprovalicarb (mix of isomers)	4.62
Ethiprole	4.63
Metalaxyl	4.63
Paclobutrazol	4.63
Spinetoram	4.64
Spinosad (Spinosyn D)	4.64
Triadimenol	4.64
Butoxycarboxim	4.65
Methabenzthiazuron	4.65
Flutolanil	4.66
Mesotrione	4.66
Methiocarb	4.68
Fipronil	4.70
Cyprodinil	4.74
Cyproconazole (mix of isomers)	4.75
Methoxyfenozide	4.75
Bupirimate	4.76
Fenamidone	4.76
Mepronil	4.77

Continued on page 10

Continued from page 9

Analyte	RT [min]
Chlorantraniliprole	4.78
Ethofumesate	4.82
Fenhexamid	4.82
Furalaxyl	4.82
Triadimefon	4.82
Neburon	4.84
Flubendiamide	4.86
Tetraconazole	4.88
Chloroxuron	4.90
Clethodim (mix of isomers)	4.90
Bifenazate	4.91
Myclobutanil	4.91
Triticonazole	4.93
Mepanipyrim	4.94
Carfentrazone-ethyl	4.99
Diflubenzuron	4.99
Hexaconazole	4.99
Tebuconazole	5.00
Triflumuron	5.04
Diniconazole	5.05
Flufenacet	5.06
Dimoxystrobin	5.10
Fenoxycarb	5.11
Penconazole	5.11
Picoxystrobin	5.12
Flusilazole	5.13
Metconazole	5.13
Butafenacil	5.15
Triflumizole	5.15
Azoxystrobin	5.16
Epoxiconazole	5.16
Mefenacet	5.20
Etaconazole (mix of isomers)	5.21
Kresoxim-methyl	5.24
Diclobutrazol	5.25
Amitraz	5.26
Benalaxyl	5.26


Analyte	RT [min]
Ipconazole (mix of isomers)	5.26
Buprofezin	5.27
Thiobencarb	5.27
Pencycuron	5.29
Bromucanazole (mix of isomers)	5.30
Tebufenpyrad	5.30
Trifloxystrobin	5.31
Cyazofamid	5.32
Fenbuconazole	5.32
Fluoxastrobin	5.32
Prochloraz	5.38
Acibenzolar-S-methyl	5.39
Propiconazole (mix of isomers)	5.40
Clofentezine	5.42
Etoazole	5.44
Flufenoxuron	5.45
Indoxacarb	5.45
Benzoximate	5.46
Tebufenozide	5.47
Piperonyl butoxide	5.49
Propargite	5.51
Furathiocarb	5.52
Spirodiclofen	5.52
Pyraclostrobin	5.53
Pyriproxyfen	5.55
Difenoconazole (mix of isomers)	5.64
Eprinomectin	5.69
Fenpyroximate	5.71
Mandipropamid	5.71
Hexythiazox	5.72
Temephos	5.73
Fenazaquin	5.78
Quinoxifen	5.78
Doramectin	5.84
Pyridaben	5.91
Rotenone	6.00

Chromatogram on page 8

Sulfa drugs

MN Appl. No. 128660

Chromatographic conditions

	Column:	EC 50/4.6 NUCLEODUR® π ² , 3 μm
	MN REF:	760633.46
	Eluent A:	0.1 % formic acid in water
	Eluent B:	0.1 % formic acid in methanol
	Gradient:	in 1.0 min from 5 % to 20 % B, in 4.0 min to 95 % B, hold 95 % B for 0.5 min, in 0.1 min to 5 % B, hold 5 % B for 4.4 min
	Flow rate:	1.3 mL/min
	Temperature:	50 °C
	Detection:	MS, MRM
	Injection:	5 μL

Concentration

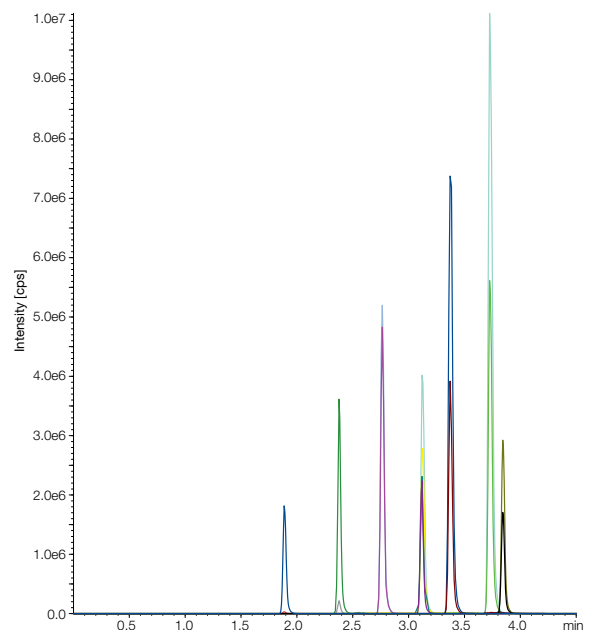
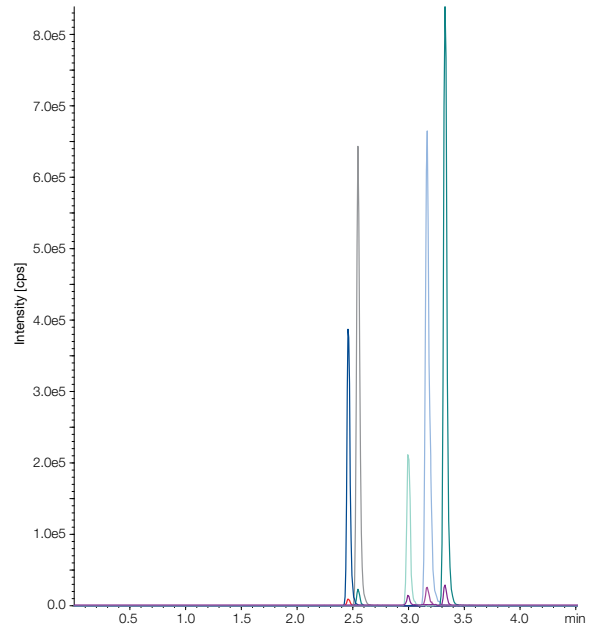
100 ng/mL in water for each analyte

MRM transitions

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Sulfatiazole	2.44	256.2	156.2	92.1
Sulfapyridine	2.53	250.2	156.1	92.0
Sulfamethoxypyridazine	2.98	281.2	156.1	92.2
Sulfamonomethoxine	3.15	281.2	156.1	92.2
Sulfachlorpyridazine	3.31	285.2	156.1	92.1

Analyte	RT [min]	[M+H] ⁺	Q ₁ (Quantifier)	Q ₂ (Qualifier)
Sulfacetamide	1.87	215.2	156.2	92.1
Sulfadiazine	2.36	251.2	156.1	92.1
Sulfamerazine	2.75	265.1	156.1	92.1
Sulfadimidine	3.11	279.2	185.9	65.0
Sulfamethoxazole	3.11	254.2	156.1	92.1
Sulfadoxine	3.36	311.1	156.1	92.1
Sulfadimethoxine	3.72	311.1	156.1	92.1
Sulfaquinoxaline	3.84	301.2	156.1	92.1

Chromatograms



Información de pedido

Longitud	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	Columnas de protección EC*
NUCLEODUR® π², 3 μm							
Columnas EC (envase de 1)							
DI 2 mm	760633.20	760635.20	760636.20	760637.20	760638.20	760639.20	761811.20 (4/2)
DI 3 mm	760633.30	760635.30	760636.30	760637.30	760638.30	760639.30	761811.30 (4/3)
DI 4 mm	760633.40	760635.40	760636.40	760637.40	760638.40	760639.40	761811.30 (4/3)
DI 4,6 mm	760633.46	760635.46	760636.46	760637.46	760638.46	760639.46	761811.30 (4/3)
NUCLEODUR® π², 5 μm							
Columnas EC (envase de 1)							
DI 2 mm	760620.20	760621.20	760622.20	760623.20	760624.20	760625.20	761810.20 (4/2)
DI 3 mm	760620.30	760621.30	760622.30	760623.30	760624.30	760625.30	761810.30 (4/3)
DI 4 mm	760620.40	760621.40	760622.40	760623.40	760624.40	760625.40	761810.30 (4/3)
DI 4,6 mm	760620.46	760621.46	760622.46	760623.46	760624.46	760625.46	761810.30 (4/3)



Selección de columnas de protección

Columnas de protección para columnas EC con DI	2 mm	3 mm	4 mm	4,6 mm
* Columnas de protección EC (envase de 3)	4 × 2 mm	4 × 3 mm	4 × 3 mm	4 × 3 mm
Soporte de columna de protección obligatorio (sistema de protección de columnas)	718966	718966	718966	718966



Soporte para columna protectora (sistema de protección de columna)



Columnas de protección EC

Marcas registradas

NUCLEODUR® MACHEREY-NAGEL GmbH & Co. KG (Alemania)
Pinnacle® Restek Corporation (EE. UU.)

Su distribuidor local

www.mn-net.com

MACHEREY-NAGEL



Management System
EN ISO 13485:2016
ISO 9001:2015

www.tuv.com
ID 0000056401



MACHEREY-NAGEL GmbH & Co. KG · Valenciener Str. 11 · 52355 Düren · Alemania

DE +49 24 21 969-0 info@mn-net.com

CH +41 62 388 55 00 sales-ch@mn-net.com

FR +33 388 68 22 68 sales-fr@mn-net.com

US +1 888 321 62 24 sales-us@mn-net.com