

MACHEREY-NAGEL

# NUCLEOSHELL<sup>®</sup> Biphenyl

Chromatography



Based on core-shell technology

- Enhanced  $\pi$ - $\pi$  interactions and remarkable efficiency
- Excellent stability in 100 % aqueous mobile phase
- Suitable for LC/MS due to low bleeding characteristics

**MACHEREY-NAGEL**

[www.mn-net.com](http://www.mn-net.com)



## Key features

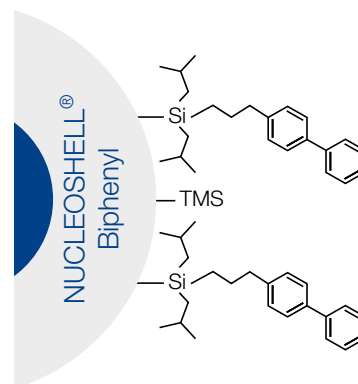
- Special biphenylpropyl core-shell phase with multi-endcapping
- Separation mode based on two retention mechanisms:  $\pi$ - $\pi$  interactions and hydrophobic interactions
- Enhanced retention for aromatic and unsaturated substances
- Excellent performance under highly aqueous conditions
- Suitable for LC/MS due to low bleeding characteristics
- Higher hydrophobicity in comparison to other aryl phases

## Recommended Applications

- Overall sophisticated analytical separations
- Aromatic and unsaturated compounds
- Mycotoxins
- Phthalates
- Pesticides
- Antibiotics
- Hormones
- Pharmaceuticals
- DNPH Aldehydes

USP L11

Similar phases: Kinetex® Biphenyl, Raptor® Biphenyl, HALO® Biphenyl



## Technical data

Biphenylpropyl modification with multi-endcapping on core-shell particles

pH stability:	1.5–8.5
Particle size:	2.7 $\mu\text{m}$ (core 1.7 $\mu\text{m}$ )
Pore size:	90 $\text{\AA}$
Specific surface:	130 $\text{m}^2/\text{g}$
Carbon content:	5.2 %

### Batch-to-batch reproducibility

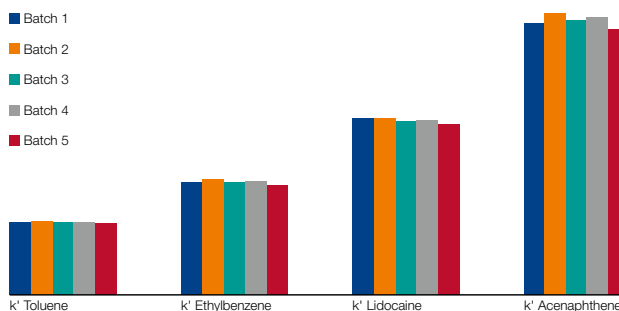
MN Appl. No. 128760

#### Chromatographic conditions

Column:	EC 50/4 NUCLEOSHELL® Biphenyl, 2.7 $\mu\text{m}$
MN REF:	763632.40
Eluent:	25 mM potassium dihydrogen phosphate solution – methanol (70:30, v/v), pH = 7.0
Flow rate:	1.0 mL/min
Run time:	10 min
Temperature:	30 °C
Detection:	UV, 254 nm
Injection:	1 $\mu\text{L}$

#### Concentration (in methanol)

Uracil	40 $\mu\text{g}/\text{mL}$ (void volume marker)
Toluene	1250 $\mu\text{g}/\text{mL}$
Ethylbenzene	1250 $\mu\text{g}/\text{mL}$
Lidocaine	500 $\mu\text{g}/\text{mL}$
Acenaphthene	230 $\mu\text{g}/\text{mL}$




### Excellent reproducibility

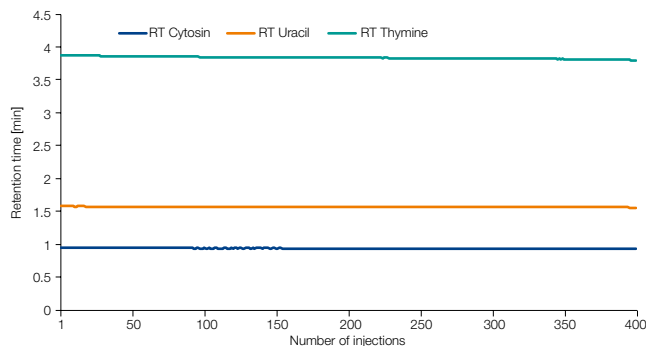
High batch-to-batch reproducibility of NUCLEOSHELL® Biphenyl columns show reliable results for different LOTS.

## Stability in 100 % aqueous eluent

MN Appl. No. 128770

### Chromatographic conditions

	Column: EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm MN REF: 763634.30 Eluent: 20 mM potassium dihydrogen phosphate solution, pH = 3.1 Gradient: isocratic Flow rate: 0.56 mL/min Run time: 10 min Temperature: 20 °C Detection: UV, 220 nm and 254 nm Injection: 0.5 µL Test mix: Cytosine, Uracil, Thymine in water
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### 100 % aqueous stability


Excellent performance and ruggedness using 100 % aqueous mobile phase.

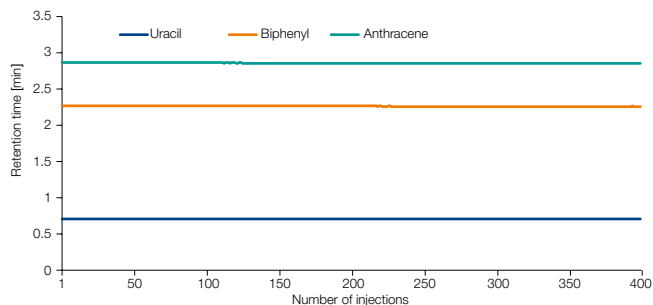


## Stability in acidic medium (isocratic method)

MN Appl. No. 128790

### Chromatographic conditions


	Column: EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm MN REF: 763634.30 Eluent: acetonitrile – water (60:40, v/v), 1 % TFA (pH = 0.8) Gradient: isocratic Flow rate: 0.56 mL/min Run time: 10 min Temperature: 60 °C Detection: UV, 254 nm Injection: 0.2 µL Test mix: Uracil, Biphenyl, Anthracene in acetonitrile
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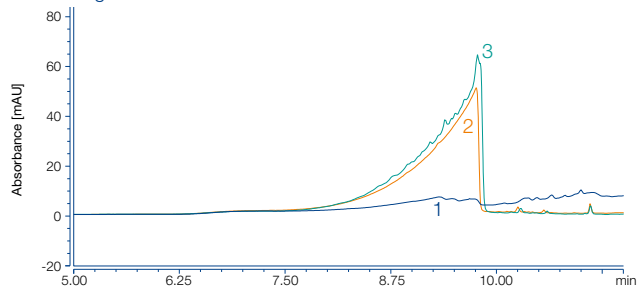
## Stability in acidic medium (gradient method)

MN Appl. No. 128780

### Chromatographic conditions

	Column: EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm MN REF: 763634.30 Eluent: A) 1 % H <sub>3</sub> PO <sub>4</sub> (pH = 1.2) B) acetonitrile Gradient: equilibration 10 min 10 % B, hold 10 % B for 5 min, from 10 % to 90 % B in 5 min, hold 90 % B for 3 min, in 1.0 min to 10 % B Flow rate: 0.56 mL/min Temperature: 40 °C Detection: UV, 254 nm 1. NUCLEOSHELL® Biphenyl, 2.7 µm 2. Kinetex® Biphenyl, 2.6 µm 3. Raptor® Biphenyl, 2.7 µm
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### Chromatogram



### Enhanced stability at low pH values


Very low bleeding characteristic in UV-VIS measurements compared to other core-shell biphenyl phases in acidic medium.



## Disperse dyes

MN Appl. No. 128800

### Chromatographic conditions


**Column:** EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm  
**MN REF:** 763634.30  
**Eluent:** A) 0.1 % formic acid in water  
           B) 0.1 % formic acid in acetonitrile  
**Gradient:** hold 5 % B for 2.0 min, in 6.0 min to 95 % B, hold 95 % B for 2.0 min, in 0.1 min to 5 % B, hold 5 % B for 4.9 min  
**Flow rate:** 0.56 mL/min  
**Temperature:** 30 °C  
**Detection:** MS, SMRM  
**Injection:** 2 µL

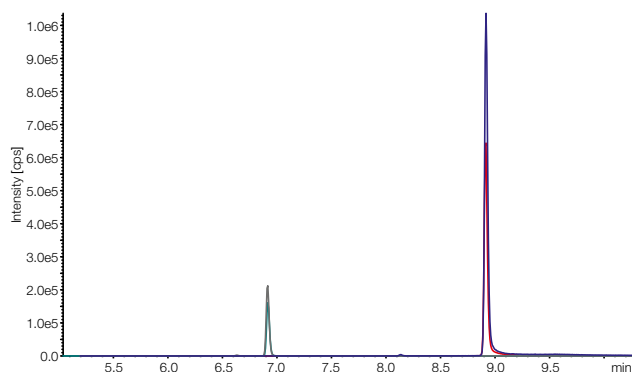
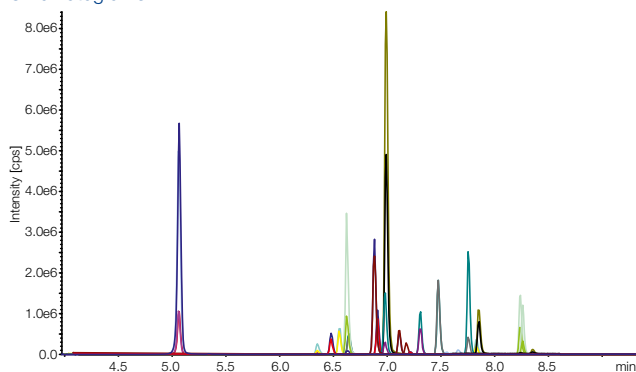
### Concentration

10 ng/mL for each analyte in water

### MRM transitions

Analyte	Polarity	RT [min]	[M+H] <sup>+</sup>	Q <sub>1</sub> (Quantifier)	Q <sub>2</sub> (Qualifier)
Basic Red 9	positive	5.0	288.2	195.0	167.0
Disperse Blue 3	positive	6.2	297.1	281.0	252.0
Disperse Red 11	positive	6.3	268.0	224.9	252.9
Basic Violet 1	positive	6.3	358.2	342.2	326.1
Disperse Yellow 9	positive	6.4	275.1	239.9	182.0
Disperse Blue 102	positive	6.4	366.1	208.0	147.1
Disperse Red 17	positive	6.5	345.1	164.0	177.0
Crystal Violet	positive	6.7	372.2	356.1	340.2
Disperse Yellow 39	positive	6.7	265.1	249.0	250.0
Disperse Yellow 3	positive	6.9	270.1	107.1	108.1
Disperse Blue 106	positive	6.9	336.1	178.1	147.0
Victoria Blue B	positive	7.1	470.3	454.3	349.1
Disperse Orange 3	positive	7.1	243.1	122.0	75.1
Disperse Brown 1	positive	7.1	433.0	197.0	357.0
Disperse Blue 35	positive	7.5	285.1	270.0	192.9
Disperse Blue 124	positive	7.6	378.1	220.0	87.1
Disperse Yellow 49	positive	7.6	375.1	238.1	223.0
Disperse Orange 11	positive	7.7	238.1	222.9	165.0
Disperse Yellow 23	positive	7.9	303.1	77.1	105.1
Disperse Blue 1	positive	8.1	269.1	237.0	161.1
Disperse Blue 26	positive	8.1	299.2	283.9	267.2
Disperse Orange 1	positive	8.2	319.1	169.0	122.0
Disperse Orange 37	positive	8.2	392.1	351.0	133.1
Analyte	Polarity	RT [min]	[M-H] <sup>-</sup>	Q <sub>1</sub> (Quantifier)	Q <sub>2</sub> (Qualifier)
Disperse Yellow 1	negative	6.8	274.0	244.0	227.0
Disperse Orange 149	negative	8.7	457.2	265.9	121.0


### Chromatograms



## Mycotoxins

MN Appl. No. 128810

### Chromatographic conditions

	Column:	EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm
	MN REF:	763634.30
	Eluent:	A) 0.1 % formic acid in water B) 0.1 % formic acid in acetonitrile
	Gradient:	hold 5 % B for 1.0 min, in 3.0 min to 40 % B, in 1.0 min to 95 % B, hold 95 % B for 1.0 min, in 1.0 min to 5 % B, hold 5 % B for 3.0 min
	Flow rate:	0.56 mL/min
	Temperature:	40 °C
	Detection:	MS, SMRM
	Injection:	20 µL

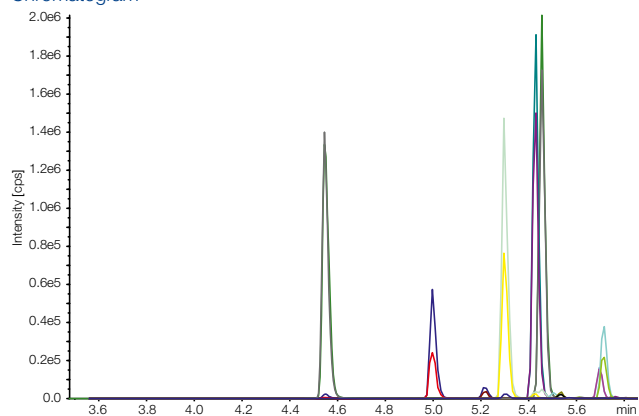
### Concentration

0.5 ng/mL fumonisin B<sub>1</sub> in water, 5.0 ng/mL for each other analyte in water

### MRM transitions

Analyte	RT [min]	[M+H] <sup>+</sup>	Q <sub>1</sub> (Quantifier)	Q <sub>2</sub> (Qualifier)
Fumonisin B <sub>1</sub>	4.55	722.2	334.2	352.3
Fumonisin B <sub>2</sub>	5.00	706.2	336.3	318.1
HT-2 toxin	5.22	425.2	263.0	215.0
Aflatoxin G <sub>2</sub>	5.30	331.1	313.0	244.9
Aflatoxin B <sub>1</sub>	5.31	313.0	285.0	241.0
Aflatoxin G <sub>1</sub>	5.43	329.0	242.9	311.0
Aflatoxin B <sub>2</sub>	5.46	315.1	287.0	258.9
T-2 toxin	5.53	467.2	305.0	244.9
Deoxynivalenol	5.65	297.1	280.2	248.8
Zearalenone	5.70	319.1	187.1	185.0
Ochratoxin A	5.72	404.0	238.8	358.0


### Chromatogram



## Pesticides

MN Appl. No. 128820

### Chromatographic conditions

 Column: EC 50/4.6 NUCLEOSHELL® Biphenyl, 2.7 µm  
 MN REF: 763632.46  
 Eluent: A) 0.1 % formic acid in water  
           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: 0.70 mL/min  
 Temperature: 30 °C  
 Detection: MS, SMRM  
 Injection: 20 µL

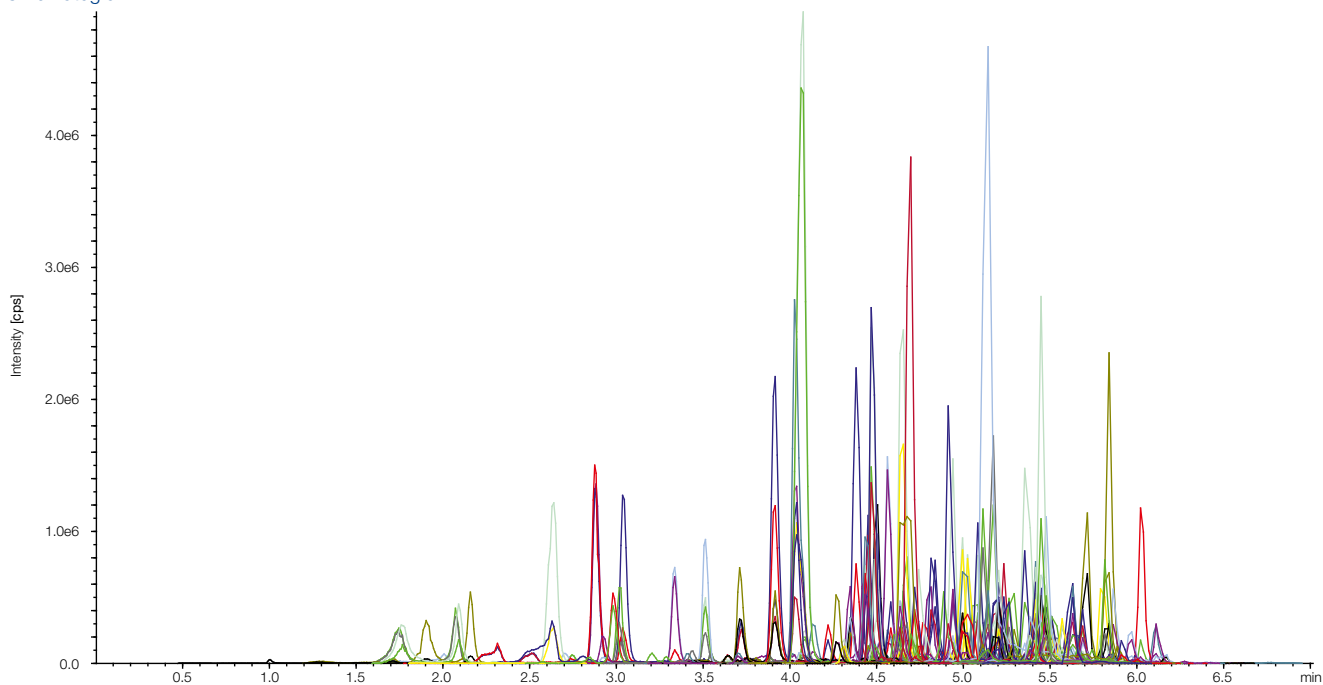
### Concentration

0.4 ng/mL in water – QuEChERS mix extract (4:1, v/v)

### Sample matrix:

2 g black tea (spiked with 50 µg/kg for each pesticide)

### Chromatogram



### Retention times/relative retention times/recovery rates

Analyte	RT [min]	Relative RT [%]†	Recovery rate [%]	Standard deviation [%]
Cyromazine	0.98	103.2	18	4.1
Methamidophos	1.70	118.9	67	10.1
Aminocarb	2.07	147.9	78	7.2
Propamocarb	2.10	161.5	26	5.8
Formetanate	2.15	158.1	68	2.5
Omethoate	2.30	119.2	81	5.1
Pymetrozine	2.31	152.0	8	17.0
Aldicarb sulfoxide	2.49	124.5	88	9.1
Carbendazim	2.62	142.4	69	6.4
Aldicarb sulfone	2.74	129.9	78	12.6
Nitenpyram	2.81	152.7	53	14.4
Mexacarbate	2.90	136.2	85	3.3
Monocrotophos	3.00	112.4	85	3.7
Flonicamid	3.01	124.9	83	4.7
Methomyl	3.01	123.4	83	4.3
Fuberidazole	3.03	132.3	72	3.2
Dicrotophos	3.31	118.2	80	2.4

Analyte	RT [min]	Relative RT [%]†	Recovery rate [%]	Standard deviation [%]
Ethirimol	3.51	135.0	41	2.8
Fenuron	3.51	115.8	85	4.9
3-Hydroxycarbofuran	3.56	114.8	87	6.2
Dimethoate	3.70	116.7	87	2.3
Imidacloprid	3.86	131.3	83	6.0
Mevinphos isomer 1	3.90	112.7	93	12.0
Mevinphos isomer 2	3.90	112.7	83	9.2
Pirimicarb	3.96	137.5	79	2.6
Cymoxanil	4.00	122.0	86	11.3
Prometon	4.06	120.5	82	2.4
Simetryn	4.07	123.7	81	2.7
Butocarboxim	4.07	120.8	91	5.7
Carbetamide	4.07	109.7	94	5.5
Aldicarb	4.08	114.9	90	6.3
Sebumeton	4.09	121.4	83	2.3
Acetamiprid	4.12	129.6	88	5.1
Imazail	4.19	130.1	72	6.8

† in relation to NUCLEOSHELL® Bluebird RP 18

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Analyte	RT [min]	Relative RT [%]†	Recovery rate [%]	Standard deviation [%]
Thidiazuron	4.26	108.7	19	16.7
Bendiocarb	4.34	111.6	93	4.5
Propoxur	4.35	113.3	84	4.2
Ametryn	4.41	116.1	83	2.9
Fluometuron	4.42	108.9	95	5.6
Carbofuran	4.43	117.5	95	5.5
Spiroxamine isomer 1	4.45	126.4	98	5.2
Spiroxamine isomer 2	4.45	126.4	107	3.2
Carbaryl 1	4.45	109.9	92	8.4
Fenpropimorph	4.47	125.9	115	2.7
Metribuzin	4.49	116.6	89	6.2
Monolinuron	4.51	110.0	92	8.0
Thiophanate-methyl	4.53	117.1	46	19.3
Propham	4.54	107.1	75	25.2
Chlorotoluron	4.55	108.3	76	8.8
Isoproc carb	4.57	107.8	86	10.3
Oxadixyl	4.60	127.8	81	10.7
Methoprotryne	4.60	121.1	84	2.8
Metobromuron	4.63	102.9	79	12.7
Forchlorfenuron	4.64	106.7	68	4.4
Isoproturon	4.66	108.1	85	9.4
Thiofanox	4.69	115.0	63	28.5
Diuron	4.69	102.0	71	12.9
Prometryne	4.70	116.6	83	6.1
Flutriafol	4.73	112.6	82	4.1
Desmedipham	4.74	107.7	119	11.4
Pyrimethanil	4.76	113.6	82	8.3
Cycluron	4.77	109.9	89	10.5
Phenmedipham	4.78	110.4	99	6.6
Methabenzthiazuron	4.81	112.4	83	8.5
Fenobucarb	4.82	109.8	97	9.4
Linuron	4.90	107.0	87	20.4
Diethofencarb	4.91	109.8	87	12.3
Promecarb	4.92	106.5	104	22.7
Halofenozide	4.93	108.1	82	21.8
Hydramethylnon	4.94	113.8	140	10.8
Metalaxyl	4.97	115.9	89	4.8
Ethiprole	4.97	110.9	87	12.7
Pacllobutrazol	4.99	108.5	88	5.0
Methiocarb	5.00	108.9	94	11.6
Flutolanil	5.01	108.0	90	6.2
Chlorantraniliprole	5.03	114.1	79	19.3
Fenamidone	5.05	110.5	82	7.1
Iprovalicarb isomer 1	5.06	106.1	96	4.4
Iprovalicarb isomer 2	5.08	106.5	96	3.6
Nuarimol	5.09	113.9	63	10.0
Ethofumesate	5.11	112.8	66	15.0
Mepro nil	5.11	108.7	89	11.7
Methoxyfenozide	5.12	108.2	93	10.4
Thiacloprid	5.13	149.6	83	3.5
Furalaxyl	5.14	113.7	89	3.8
Cyproconazole isomer 1	5.14	110.5	87	4.5
Cyproconazole isomer 2	5.14	109.6	90	4.0
Cyprodinil	5.15	111.0	83	14.0
Boscalid	5.16	114.7	95	10.2
Chloroxuron	5.16	108.9	84	14.7
Triadimefon	5.18	111.4	88	12.0
Bifenazate	5.19	110.4	119	16.2
Bupirimate	5.20	117.4	86	11.3
Tetraconazole	5.20	109.7	101	13.2
Mepanipyrim	5.20	107.4	77	11.5
Neburon	5.21	105.7	93	11.5
Carfentrazone-ethyl	5.22	115.7	97	13.2

† in relation to NUCLEOSHELL® Bluebird RP 18

Analyte	RT [min]	Relative RT [%]†	Recovery rate [%]	Standard deviation [%]
Diclobutrazol	5.25	108.9	93	11.3
Tebufenozide	5.26	109.4	92	11.7
Diffubenzuron	5.27	108.7	90	11.4
Fenarimol	5.33	112.9	89	8.7
Azoxystrobin	5.34	116.8	95	4.5
Tebuconazole	5.35	108.1	85	8.4
Hexaconazole	5.35	107.0	91	12.0
Fenoxycarb	5.36	109.2	114	13.0
Acibenzolar-S-methyl	5.38	114.7	77	14.4
Spirotetramat	5.39	113.2	55	18.7
Flusilazole	5.39	111.4	92	10.3
Picoxystrobin	5.39	108.5	110	8.7
Prothioconazole	5.40	109.5	54	23.3
Penconazole	5.40	109.3	91	6.4
Dimoxystrobin	5.41	109.5	103	8.4
Epoxiconazole	5.43	112.7	86	6.9
Diniconazole	5.43	106.7	105	15.3
Mefenacet	5.44	114.8	89	9.9
Bitertanol	5.44	109.7	91	16.9
Metconazole	5.45	109.0	76	16.7
Butafenacil	5.46	114.9	114	12.5
Etaconazole isomer 1	5.47	115.6	89	8.8
Dimethomorph isomer 2	5.48	118.4	88	6.7
Fluquinconazole	5.48	116.8	90	14.6
Fenbuconazole	5.48	113.7	94	13.1
Dimethomorph isomer 1	5.49	118.6	89	6.1
Kresoxim-methyl	5.49	109.8	78	17.2
Fluoxastrobin	5.50	114.6	117	25.8
Mandipropamid	5.53	114.0	84	11.7
Famoxadone	5.53	112.4	125	24.5
Thiobencarb	5.56	108.4	90	13.7
Iponazole isomer 1	5.56	107.5	96.4	11.2
Iponazole isomer 2	5.56	107.5	104	14.8
Amitraz	5.59	111.6	92	19.9
Benalaxyl	5.59	111.1	98	11.4
Penycuron (Monceren)	5.60	109.8	90	6.7
Bromuconazole isomer 2	5.62	119.6	99	12.1
Clofentezine	5.62	108.9	92	14.4
Propiconazole isomer 1	5.64	113.0	93	8.9
Propiconazole isomer 2	5.64	113.0	86	8.2
Benzoximate	5.65	109.5	99	10.9
Pyraclostrobin	5.68	111.4	96	10.8
Prochloraz	5.69	116.8	96	8.0
Tebufenpyrad	5.69	107.6	132	7.5
Bromuconazole isomer 1	5.70	121.3	89	25.4
Buprofezin	5.70	110.3	114	4.6
Difenoconazole isomer 1	5.78	113.8	101	11.5
Piperonyl butoxide	5.81	108.0	111	3.7
Pyriproxyfen	5.82	107.4	112	3.5
Furathiocarb	5.85	110.4	113	6.4
Quinoxifen	5.97	110.1	95	4.8
Hexythiazox	5.98	110.5	121	10.7
Rotenone	6.00	121.2	100	19.7

## Fast analyses for sophisticated separations

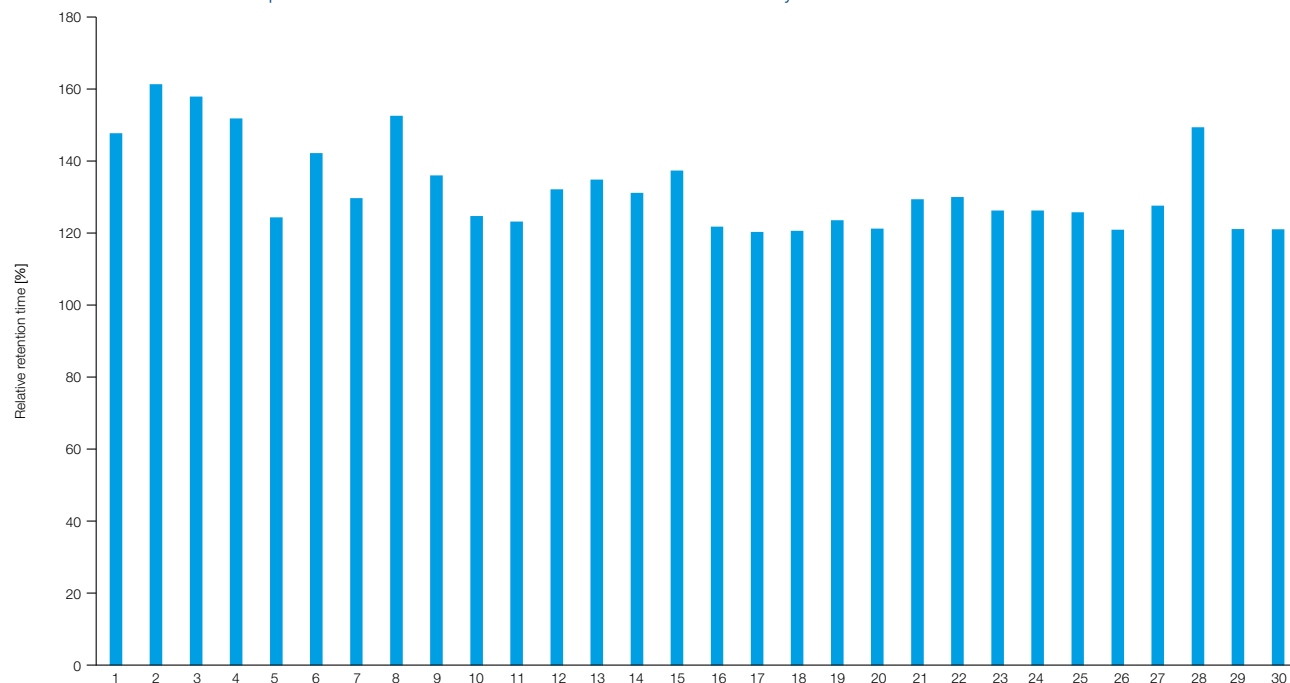
LC/MS analysis of more than 150 pesticides in less than 6.5 minutes on NUCLEOSHELL® Biphenyl.



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Relative retention times in comparison to NUCLEOSHELL® Bluebird RP 18 for selected analytes



1 Aminocarb	9 Mexacarbate	17 Cymoxanil	25 Fenpropimorph
2 Propamocarb	10 Flonicamid	18 Butocarboxim	26 Methoprotryne
3 Formetanate HCl	11 Methomyl	19 Simetryn	27 Oxadixyl
4 Pymetrozine	12 Fuberidazole	20 Secbumeton	28 Thiacloprid
5 Aldicarb sulfoxide	13 Ethirimol	21 Acetamidiprid	29 Bromucanazole isomer 1
6 Carbenfendazim	14 Imidacloprid	22 Imazalil	30 Rotenone
7 Aldicarb sulfone	15 Primidicarb	23 Spiroxamine isomer 1	
8 Nitenpyram	16 Prometon	24 Spiroxamine isomer 2	



### Alternative selectivity and high hydrophobicity

Highly increased retention (alternative selectivity) for certain aryl compounds compared to a core-shell octadecylsilyl modification in methanol. The comparison with NUCLEOSHELL® Bluebird RP 18 also proves the high hydrophobicity compared to other aryl phases.






## Phthalates

MN Appl. No. 128830

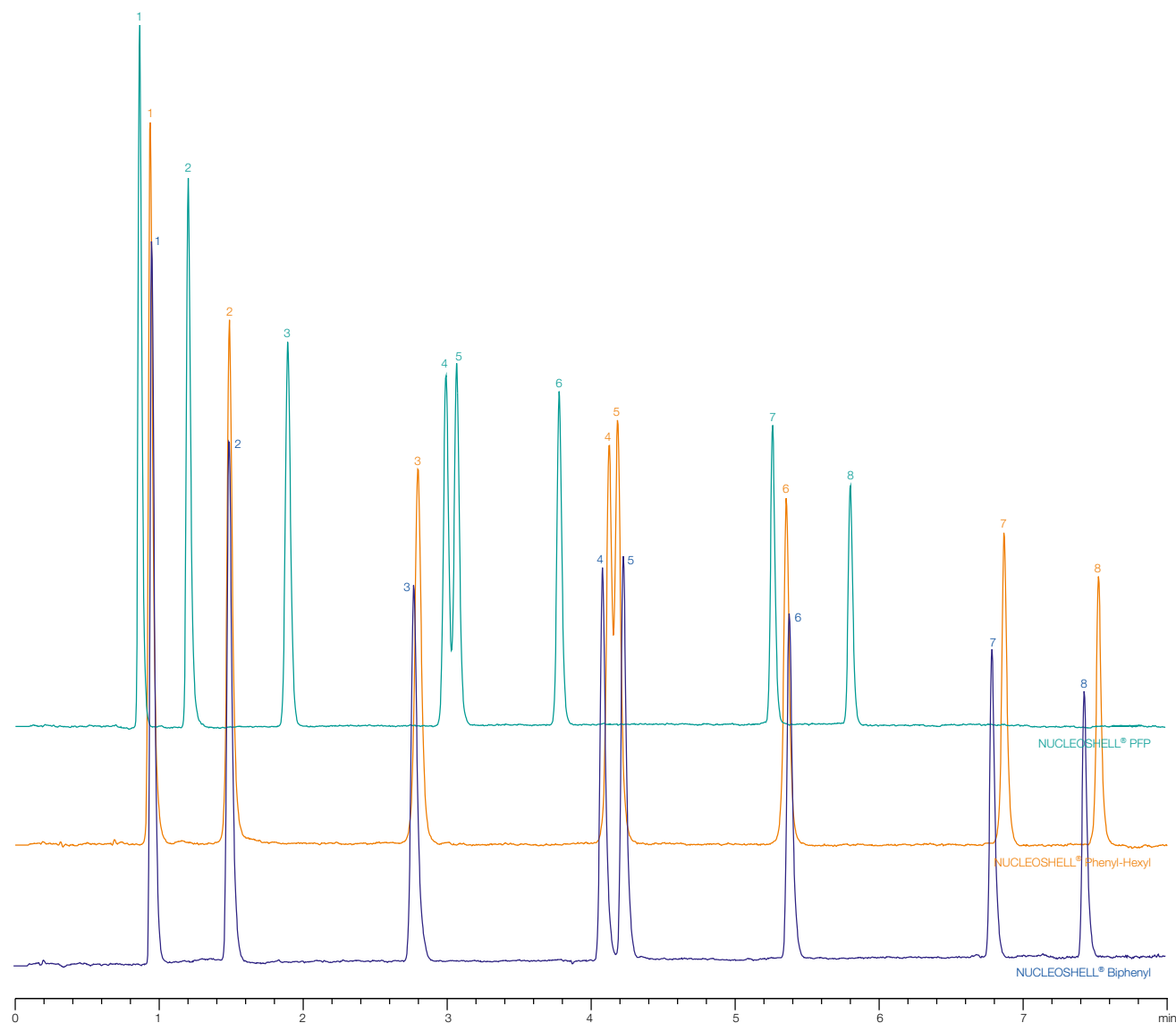
### Chromatographic conditions


**Column:** EC 100/3 NUCLEOSHELL® Biphenyl, 2.7 µm  
 EC 100/3 NUCLEOSHELL® Phenyl-Hexyl, 2.7 µm  
 EC 100/3 NUCLEOSHELL® PFP, 2.7 µm  
**MN REF:** 763634.30, 763734.30, 763534.30  
**Eluent:** A) water  
 B) 0.1 % water in acetonitrile  
**Gradient:** hold 50 % B for 1.5 min, in 6.0 min to 95 % B, hold 95 % B for 3.5 min, in 2.0 min to 50 % B, hold 50 % B for 4.5 min  
**Flow rate:** 1.0 mL/min  
**Temperature:** 30 °C  
**Detection:** UV, 228 nm  
**Injection:** 5 µL

### Concentration

10.0 ng/mL for each analyte in water – acetonitrile (1:1, v/v)

### Chromatograms



### Retention times

Analyte	Biphenyl RT [min]	Phenyl-Hexyl RT [min]	PFP RT [min]
1 Dimethyl phthalate	0.96	0.94	0.86
2 Diethyl phthalate	1.50	1.49	1.20
3 Dipropyl phthalate	2.87	2.80	1.89
4 Dibutyl phthalate	4.09	4.13	2.99
5 Benzyl butyl phthalate	4.24	4.19	3.07
6 Dicyclohexyl phthalate	5.39	5.36	3.78
7 Diheptyl phthalate	6.80	6.87	5.26
8 Dioctyl phthalate	7.44	7.53	5.80

### Superior aromatic selectivity


NUCLEOSHELL® Biphenyl is able to baseline separate the critical pair dibutyl phthalate / benzyl butyl phthalate whereas other aryl phases cannot achieve this.



## Estrogens

MN Appl. No. 128850

### Chromatographic conditions

	Column: EC 50/2 NUCLEOSHELL® Biphenyl, 2.7 µm MN REF: REF 763632.20 Eluent: A) 0.01 mM ammonium fluoride in water B) acetonitrile Gradient: from 10 % to 50 % B in 15 min, in 1.0 min to 99 % B, hold 99 % B for 1.5 min, in 0.5 min to 10 % B, hold 10 % B for 3.0 min Flow rate: 0.30 mL/min Temperature: 30 °C Detection: MS, MRM Injection: 20 µL
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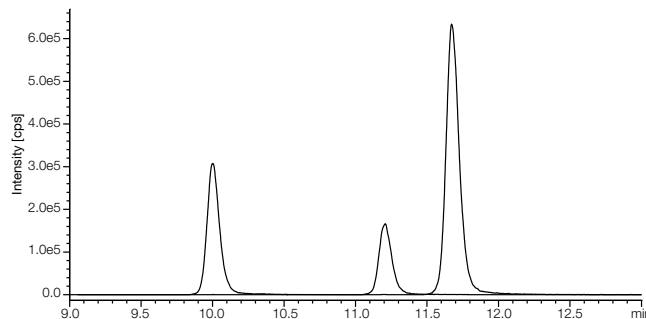
### Concentration

10.0 ng/mL for each analyte in eluent A – methanol (9:1, v/v)

### MRM transitions

Analyte	RT [min]	[M-H] <sup>-</sup>	Q <sub>1</sub> (Quantifier)	Q <sub>2</sub> (Qualifier)
Estradiol	10.0	271.3	183.3	145.3
Estrone	11.2	295.3	145.2	143.3
Ethinylestradiol	11.7	269.3	145.2	267.2


### Chromatogram



## DNPH aldehydes

MN Appl. No. 128840

### Chromatographic conditions

	Column: EC 50/3 NUCLEOSHELL® Biphenyl, 2.7 µm MN REF: REF 763632.30 Eluent: A) water B) acetonitrile Gradient: in 5.0 min from 10 % to 72 % B, hold 72 % B for 1.0 min, in 1.0 min to 10 % B, hold 10 % B for 5.0 min Flow rate: 2.0 mL/min Temperature: 40 °C Detection: UV, 360 nm Injection: 10 µL
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### Concentration

0.5 µg/mL for each analyte in water – acetonitrile (95:5, v/v)

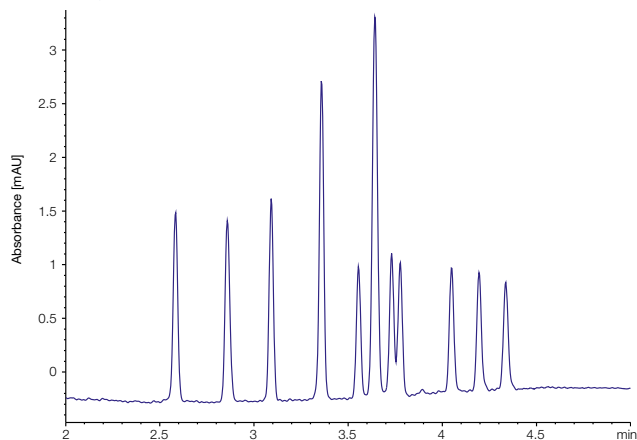
### Retention times

Analyte	RT [min]
Formaldehyde	2.58
Acetaldehyde	2.86
Acetone	3.09
Isobutyraldehyde + <i>p</i> -Tolualdehyde	3.36
Hexanal	3.55
Butanal + <i>o</i> -/ <i>m</i> -Tolualdehyde	3.64
Pentanal	3.73
2,5-Dimethylbenzaldehyde	3.77
Octanal	4.05
Nonanal	4.19
Decanal	4.36

For further analytes the following retention times have been determined (not presented in the chromatogram):

Analyte	RT [min]
Propanal	3.14
Acrolein	3.23
Isovaleraldehyde	3.56
Benzaldehyde	3.59
Crotonaldehyde	3.17
Cyclohexanon	3.77


### Chromatogram



## Algal toxins in mussels

MN Appl. No. 128860

### Chromatographic conditions


**Column:** EC 150/3 NUCLEOSHELL® Biphenyl, 2.7 µm  
 EC 250/2 NUCLEODUR® π², 5 µm  
**MN REF:** 763636.30, 760625.20  
**Eluent:** A) 50 mM formic acid  
 B) methanol  
**Gradient:** hold 79 % B for 4.0 min, in 0.1 min to 83 % B, in 10.9 min to 86 % B, in 0.1 min to 98 % B, hold 98 % B for 2.9 min, in 0.1 min to 79 % B  
**Flow rate:** 0.30 mL/min  
**Temperature:** 40 °C  
**Detection:** MS, MRM  
**Injection:** 10 µL

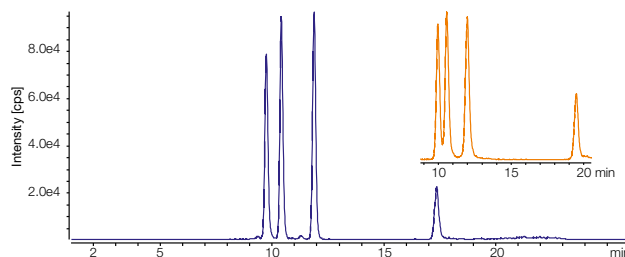
### Concentration

10.0 ng/mL for each analyte

### MRM transitions

Analyte	RT [min]	[M+H] <sup>+</sup>	Q <sub>1</sub> (Quantifier)	Q <sub>2</sub> (Qualifier)
Okadaic acid	9.5	827.5	809.4	723.4
Dinophysistoxin-2	10.3	827.5	809.4	723.4
Dinophysistoxin-1	11.7	841.5	823.4	737.4
Pectenotoxin-2	17.3	881.3	837.4	539.3

### Chromatograms



### Advantage of core-shell vs fully porous particles

Improved peak shape and better baseline separation with NUCLEOSHELL® Biphenyl in comparison to NUCLEODUR® π².



We thank TeLA GmbH for the cooperation and for the method development of this application.



# NUCLEOSHELL® Biphenyl

## Ordering information

Length	50 mm	100 mm	150 mm
NUCLEOSHELL® Biphenyl, 2.7 µm			
EC columns (pack of 1)			
2 mm ID	763632.20	763634.20	763636.20
3 mm ID	763632.30	763634.30	763636.30
4 mm ID	763632.40	763634.40	763636.40
4.6 mm ID	763632.46	763634.46	763636.46



## Extend your column lifetime with our selection of guard columns

For EC column with ID of	REF guard column	Required guard column holder (Column protection system)
2 mm	EC 4/2 (pack of 3)	718966
3/4/4.6 mm	EC 4/3 (pack of 3)	718966



### Registered trademarks

NUCLEOSHELL®	MACHEREY-NAGEL GmbH & Co. KG (Germany)
Kinetex®	Phenomenex (USA)
Raptor®	Restek (USA)
HALO®	Advanced Materials Technology (USA)

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