



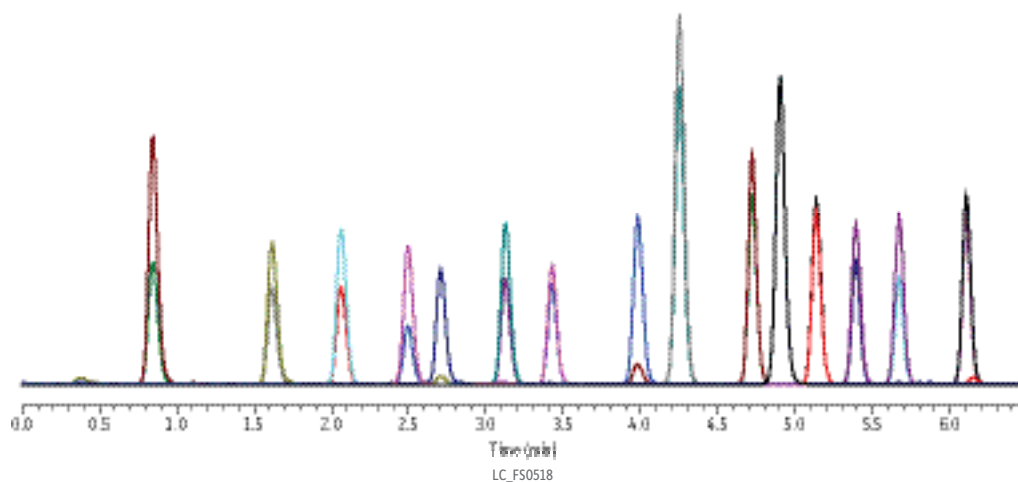
**Featured Application:** *Bisphenols on Raptor Biphenyl*

## Comprehensive LC-MS/MS Analysis of 15 Bisphenols in 8 Minutes

- Excellent peak shape and separation for bisphenol A and common analogues.
- Simple, no-additives mobile phases and gradient program.
- Fast, 8-minute total cycle time.

Bisphenol A (BPA), widely used in the production of polycarbonate plastic and epoxy resins, is an endocrine disruptor that imitates naturally occurring hormones or acts as an antagonist, both of which can cause harmful effects on hormone biosynthesis, metabolism, distribution, and mode of action. Hormone disruption can result in detrimental effects to health, growth, and reproduction. Children and unborn babies are most susceptible to hormonal and neurological development problems, and the prevalent use of BPA in many consumer products, including food and beverage packaging, adhesives, and toys, has caused several governments to investigate its safety. Due to the wide range of exposure routes and vulnerability of children, negative public perception has driven many products to advertise as “BPA-free,” instead opting to use BPA analogues that have similar physicochemical properties. However, these alternate bisphenols are understudied and may also have harmful toxicological profiles. Some research has shown that these compounds, notably BPF, BPS, BPAF, BPZ, BPE, and BPB, are estrogenic endocrine disruptors and may cause health effects similar to BPA [1,2].

Establishing accurate methods for the analysis of bisphenols that include a broad suite of compounds, rather than just BPA, is imperative for both investigating toxicology and monitoring human exposure. The simple LC-MS/MS gradient method presented here was developed on a Raptor Biphenyl column because it provides excellent chromatographic peak shape and baseline separation of 15 bisphenols, including BPA and its most prevalent analogues. The 1.8  $\mu\text{m}$ , 2.1 x 50 column format takes advantage of the inherent speed gains of small particle size technology, resulting in a fast, 8-minute analysis that is ideal for high-throughput testing.



Peaks	tr (min)	Conc. (ng/mL)	Precursor Ion	Product Ion	Product Ion
1. Bisphenol S	0.84	5.00	249.2	108.1	92.1
2. Bisphenol F	1.62	350	199.3	93.1	105.1
3. Bisphenol E	2.06	100	213.3	198.3	197.4
4. Bisphenol A	2.50	100	227.3	212.3	133.1
5. Bisphenol AF	2.71	2.00	335.2	265.3	177.3
6. Bisphenol B	3.13	100	241.3	212.4	211.3
7. Bisphenol C	3.43	350	255.3	240.4	147.3
8. Bisphenol AP	3.98	25.0	289.3	274.3	273.3
9. Bisphenol Z	4.25	250	267.2	173.4	145.2
10. Bisphenol G	4.72	250	311.2	295.4	296.4
11. Bisphenol FL	4.90	50.0	348.8	256.2	-
12. Bisphenol BP	5.14	50.0	351.2	273.3	274.3
13. Bisphenol M	5.39	15.0	345.2	330.3	251.4
14. Bisphenol P	5.67	50.0	345.2	330.4	315.3
15. Bisphenol PH	6.11	350	379.2	209.4	364.4

**Column** Raptor Biphenyl (cat.# 9309252)  
**Dimensions:** 50 mm x 2.1 mm ID  
**Particle Size:** 1.8 µm  
**Pore Size:** 90 Å  
**Temp.:** 25 °C

**Sample**  
**Diluent:** 75:25 Water:methanol  
**Conc.:** 2.00-350 ng/mL  
**Inj. Vol.:** 2 µL

#### Mobile Phase

**A:** Water  
**B:** Methanol

Time (min)	Flow (mL/min)	%A	%B
0.00	0.45	50	50
6.50	0.45	10	90
6.51	0.45	50	50
8.00	0.45	50	50

**Detector** MS/MS  
**Ion Mode:** ESI-  
**Mode:** MRM  
**Instrument** UHPLC

## References

- [1] R. Mesnage, A. Phedonos, M. Arno, S. Balu, J.-C. Corton, M.N. Antoniou, Transcriptome profiling reveals bisphenol A alternatives activate estrogen receptor alpha in human breast cancer cells. *Toxicol. Sci.* 158 (2) (2017) 431-443. <https://doi.org/10.1093/toxsci/kfx101>
- [2] R. Barouki, E. Tarroja, C. Persoz, C. Thomsen, E. Heyvaert, H. Reyders, K. Van Campenhout, G. Schoeters, C. Ganzleben, C. Hartmann, M. Uhl, J.-P. Antignac, L. Debrauwer, N. Janey Holcer, N. Cingotti, N. Reineke, Scoping documents: prioritized substance group: bisphenols. HBM4EU (2018) 1-21. <https://www.hbm4eu.eu/wp-content/uploads/2017/04/scoping-document-on-bisphenols.pdf>

### Column Characteristics:

Stationary Phase Category: Phenyl (L11)

Ligand Type: Biphenyl

Particle: 1.8 µm, 2.7 µm, or 5 µm superficially porous silica (SPP or "core-shell")

Pore Size: 90 Å

Carbon Load: 7% (1.8 µm), 7% (2.7 µm), 5% (5 µm)

End-Cap: yes

Surface Area: 125 m<sup>2</sup>/g (1.8 µm), 130 m<sup>2</sup>/g (2.7 µm), or 100 m<sup>2</sup>/g (5 µm)

Recommended Usage:

pH Range: 2.0 to 8.0

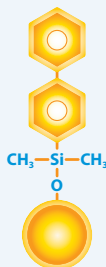
Maximum Temperature: 80 °C

Maximum Pressure: 1,034 bar/15,000 psi\* (1.8 µm), 600 bar/8,700 psi (2.7 µm); 400 bar/5,800 psi (5 µm)

\* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.

Properties:

- Increased retention for dipolar, unsaturated, or conjugated solutes.
  - Enhanced selectivity when used with methanolic mobile phase.
  - Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Switch to a Biphenyl when:
- Limited selectivity is observed on a C18.
  - You need to increase retention of hydrophilic aromatics.



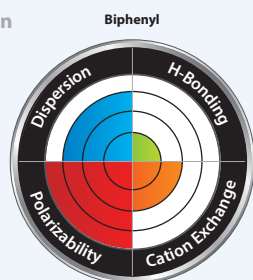
## Raptor Biphenyl LC Columns (USP L11)

### Chromatographic Properties

The innovative Biphenyl is Restek's most popular LC stationary phase because it is particularly adept at separating compounds that are hard to resolve or that elute early on C18 and other phenyl chemistries. As a result, the rugged Raptor Biphenyl column is extremely useful for fast separations in bioanalytical testing applications like drug and metabolite analyses, especially those that require a mass spectrometer (MS). Increasing retention of early-eluting compounds can limit ionization suppression, and the heightened selectivity helps eliminate the need for complex mobile phases that are not well suited for MS detection.

Length	2.1 mm cat.#	3.0 mm cat.#	4.6 mm cat.#
<b>1.8 µm Columns</b>			
30 mm	9309232	—	—
50 mm	9309252	930925E	—
100 mm	9309212	930921E	—
150 mm	9309262	—	—
<b>2.7 µm Columns</b>			
30 mm	9309A32	9309A3E	9309A35
50 mm	9309A52	9309A5E	9309A55
100 mm	9309A12	9309A1E	9309A15
150 mm	9309A62	9309A6E	9309A65
<b>5 µm Columns</b>			
30 mm	—	930953E	—
50 mm	9309552	930955E	9309555
100 mm	9309512	930951E	9309515
150 mm	9309562	930956E	9309565
250 mm	—	—	9309575

### USLC Column Interaction Profile





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