

THE RESTEK ADVANTAGE

Turning Visions into Reality™

2005 vol. 2

Rtx®-PCB: Unique Selectivity for PCBs

110 of 158 target PCB Congeners Elute Individually, Using GC/ECD

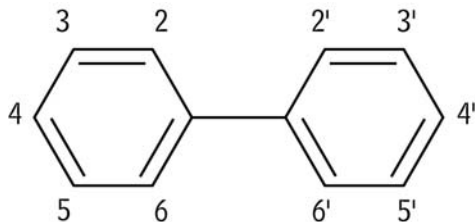
by Gary Stidsen, GC Columns Marketing Manager

- NEW low polarity, inert polymer phase provides distinct separations of PCB congeners.
- Unmatched selectivity and low bleed—a column of choice for trace analysis.
- Thermally stable to 340°C.

Rtx®-PCB columns show unique selectivity for polychlorinated biphenyl (PCB) congeners. In previous publications (lit.# 59925 and Advantage 2005v1, lit.# 59077, page 13), we discussed the excellent performance of this column and showed each of the European PCB congener indicator compounds - PCBs 28, 52, 101, 118, 138, 153, and 180 - can be resolved from other, interfering PCB congeners and quantified, using GC/MS.

“Weathering” of Aroclor® mixes that have been in the environment for more than 30 years, and changes in Aroclor® patterns in tissue samples, due to bioaccumulation, have dictated that PCBs now be reported as congeners, rather than as Aroclor® mixes. Consequently, many laboratories are analyzing longer lists of PCB congeners, using the data in determining specific congener patterns, in compiling congener results to obtain an accurate total PCB concentration, and in other ways.

Figure 1 Biphenyl structure supports 209 PCB congeners, many with very similar retention characteristics.



The structure of the biphenyl molecule is shown in Figure 1. Identification and quantification of PCB congeners is chromatographically challenging because there are 209 possible combinations in which chlorine atoms can be added to the biphenyl structure, ranging from addition

of a single chlorine (monochlorobiphenyls) to addition at every available carbon atom (decachlorobiphenyl). In 1996, George Frame published work he performed in order to determine which PCB congeners are present in Aroclor® mixes.¹ Using this work as a guide, the list of 209 possible PCB congeners can be reduced to a target list of 158 congeners. This final target list includes PCB congeners found in Aroclor® mixes above 0.01%wt/wt, and a few compounds not detected in Aroclor® mixes, but detected in tissue due to

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Restek Goes West!



Roy Lautamo gliding over Kings Canyon in the southern Sierra.

Restek celebrates continued growth in 2005 with the opening of Restek West, our new R&D facility in Shingle Springs, California. Roy Lautamo, Director of Innovative Research Chemistries, will manage the facility, focusing on R&D for our chromatography column product lines. Roy has an extensive range of experience in chromatography, acquired over more than a quarter of a century of research.

We welcome Roy and his staff into the Restek family!

Correction

In *Advantage 2005v1: Fast GC/MS Analysis of Semivolatile Organic Compounds*, Figure 1 (page 14) the splitless hold time and pressure pulse time are reversed. The splitless hold time should be 0.15 min. and the pressure pulse time should be 0.20 min. We apologize for any inconvenience caused by this error.

bioaccumulation (e.g., PCB#169). The list encompasses the seven European indicator compounds and the 12 most toxic congeners, according to the World Health Organization (WHO) list.²

Using a 40m x 0.18mm ID, 0.18µm film Rtx®-PCB column and the conditions listed in Figure 2, we evaluated a sample composed of Aroclor® PCB mixes 1242, 1254, and 1262. The 158 target PCB congeners were identified in the sample, eluted as 135 chromatographic peaks. Of the 158 congeners, 110 eluted singly and 48 were unresolved.

Produced through one of our newest polymer technologies, Rtx®-PCB columns undergo rigorous quality assurance measures, to ensure every column meets exacting standards and to give you highly reproducible performance, from column to column. If you are analyzing PCBs—as congeners, as Aroclor® mixtures, or as other mixtures (e.g., Kaneclor, Clophen, or Phenoclor mixes)—we highly recommend using these new columns.

References

1. Frame, G., J. Cochran, and S. Bowadt, *Complete PCB Congener Distributions for 17 Aroclor Mixtures Determined by 3 HRGC Systems Optimized for Comprehensive, Quantitative, Congener-Specific Analysis* J. High Res. Chromatogr. 19, Dec. 1996, pp. 657-668.
2. Executive Summary, *Assessment of the Health Risk of Dioxins: Re-evaluation of the Tolerable Daily Intake (TDI)*, WHO Consultation, May 25-29, 1998, Geneva Switzerland. See: <http://www.who.int/ipcs/publications/en/exe-sum-final.pdf>

PCB Congener Standard #2

| | |
|-----------------------|----------------------------|
| 2,4,4' (BZ #28) | 2,2',3,4,4',5' (BZ #138) |
| 2,2',5,5' (BZ #52) | 2,2',4,4',5,5' (BZ #153) |
| 2,2',4,5,5' (BZ #101) | 2,2',3,4,4',5,5' (BZ #180) |
| 2,3',4,4',5 (BZ #118) | |

10µg/mL each in isoctane, 1mL/ampul
cat. # 32294 (ea.)

For additional PCB congener mixes, and Aroclor® reference materials, please see our current catalog, or visit our website.

Rtx®-PCB (fused silica)

| ID | df (µm) | temp. limits | length | cat. # |
|--------|---------|-------------------|----------|--------|
| 0.18mm | 0.18 | 30°C to 320/340°C | 20-Meter | 41302 |
| 0.18mm | 0.18 | 30°C to 320/340°C | 60-Meter | 41304 |
| 0.25mm | 0.25 | 30°C to 320/340°C | 30-Meter | 13223 |
| 0.25mm | 0.25 | 30°C to 320/340°C | 60-Meter | 13226 |
| 0.32mm | 0.50 | 30°C to 320/340°C | 30-Meter | 13239 |

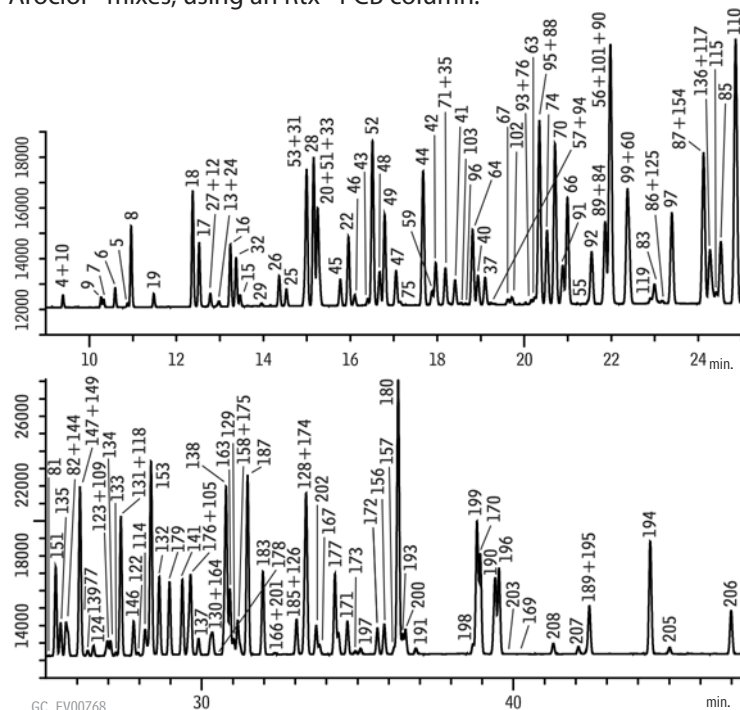
The maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

Table I 110 of 158 target PCB congeners in Aroclor® mixes are eluted singly from an Rtx®-PCB column.

| PCB# | s/m* | PCB# | s/m* | PCB# | s/m* | PCB# | s/m* | PCB# | s/m* |
|------|------|------|------|------|------|------|------|------|------|
| 1 | s | 35 | s | 82 | s | 126 | s | 173 | s |
| 2 | s | 37 | s | 83 | s | 128 | m | 174 | m |
| 3 | s | 40 | s | 84 | m | 129 | s | 175 | s |
| 4 | m | 41 | s | 85 | s | 130 | s | 176 | m |
| 5 | s | 42 | s | 86 | m | 131 | m | 177 | s |
| 6 | s | 43 | s | 87 | m | 132 | s | 178 | s |
| 7 | s | 44 | s | 88 | m | 133 | s | 179 | s |
| 8 | s | 45 | s | 89 | m | 134 | s | 180 | s |
| 9 | s | 46 | s | 90 | m | 135 | s | 183 | s |
| 10 | m | 47 | s | 91 | s | 136 | m | 185 | s |
| 11 | m | 48 | s | 92 | s | 137 | s | 187 | s |
| 12 | m | 49 | s | 93 | m | 138 | s | 189 | s |
| 13 | m | 51 | m | 94 | m | 139 | s | 190 | m |
| 15 | s | 52 | s | 95 | m | 141 | s | 191 | s |
| 16 | s | 53 | m | 96 | s | 144 | s | 193 | s |
| 17 | m | 54 | m | 97 | s | 146 | s | 194 | s |
| 18 | s | 55 | s | 99 | m | 147 | m | 195 | s |
| 19 | s | 56 | m | 101 | m | 149 | m | 196 | m |
| 20 | m | 57 | m | 102 | s | 151 | s | 197 | s |
| 21 | m | 59 | s | 103 | s | 153 | s | 198 | s |
| 22 | s | 60 | m | 105 | m | 154 | m | 199 | s |
| 23 | m | 63 | s | 109 | m | 156 | s | 200 | s |
| 24 | m | 64 | s | 110 | s | 157 | s | 201 | s |
| 25 | s | 66 | s | 114 | s | 158 | s | 202 | s |
| 26 | s | 67 | s | 115 | s | 163 | s | 203 | s |
| 27 | m | 70 | s | 117 | m | 164 | s | 205 | s |
| 28 | s | 71 | s | 118 | m | 166 | s | 206 | s |
| 29 | s | 74 | s | 119 | s | 167 | s | 207 | s |
| 31 | m | 75 | s | 122 | s | 169 | s | 208 | s |
| 32 | s | 76 | m | 123 | m | 170 | s | 209 | s |
| 33 | m | 77 | m | 124 | s | 171 | s | | |
| 34 | s | 81 | s | 125 | m | 172 | s | | |

*s - compound eluted singly; m - compound eluted with one or more other congeners.

Figure 2 Excellent separation and peak shape for PCBs in three Aroclor® mixes, using an Rtx®-PCB column.



Column: Rtx®-PCB 40m, 0.18mm ID, 0.18µm (cat.# 41303)
Sample: 300ng/mL Aroclor® 1242/1254/1262 in hexane: Aroclor® 1242 (cat.# 32009), Aroclor® 1254 (cat.# 32011), Aroclor® 1262 (cat.# 32409)
Inj.: 1.0µL splitless (hold 0.75 min.), 4mm single gooseneck inlet liner (cat.# 20983)
Inj. temp.: 230°C
Carrier gas: hydrogen, constant pressure
Linear velocity: 40cm/sec. @ 100°C
Oven temp.: 100°C (hold 1 min.) to 200°C @ 30°C/min., to 320°C @ 2°C/min. (hold 1 min.)
Det.: ECD @ 330°C