THE ANALYSIS OF PCB CONGENERS USING A SELECTIVE PCB CAPILLARY COLUMN

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INTRODUCTION

The use of Polychlorinated Biphenyls (PCBs) compounds was common place prior to 1970 before their affect on public health came to light. Applications such as heat transfer fluids, dielectrics (insulators) in transformer cooling liquids, heat-transfer and hydraulic fluids, vacuum pump fluids, lubricants, plasticisers, fillers in investment casting waxes, surface coatings and sealants, pesticide extenders, and copy paper were common for PCBs. The use of PCBs is now banned in many countries due to their harmful effects on public health. A select few of the planar PCBs exhibit dioxin-like properties and toxicities; the carcinogenic effects of many of the other PCBs have brought the need for strict monitoring procedures within environmental regulating bodies around the world. Monitoring of soil, water and food stuffs for PCBs is common place in environmental laboratories.

WHAT ARE PCBS?

Polychlorinated Biphenyls consist of 209 congeners and are classed as persistent organic pollutants (POPs). They are considered to be one of the "dirty dozen", a group of persistent organic pollutants which include dioxins, furans and a number of organochlorine pesticides such as DDT because of their extreme chemical stability and ability to accumulate within the food chain. **Figure 1** shows the basic structure of polychlorinated biphenyls where the R groups can be any combination of chlorine or hydrogen atoms.

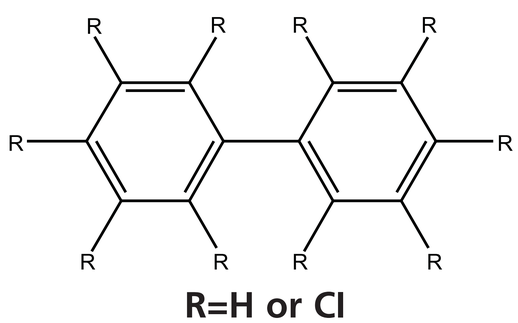
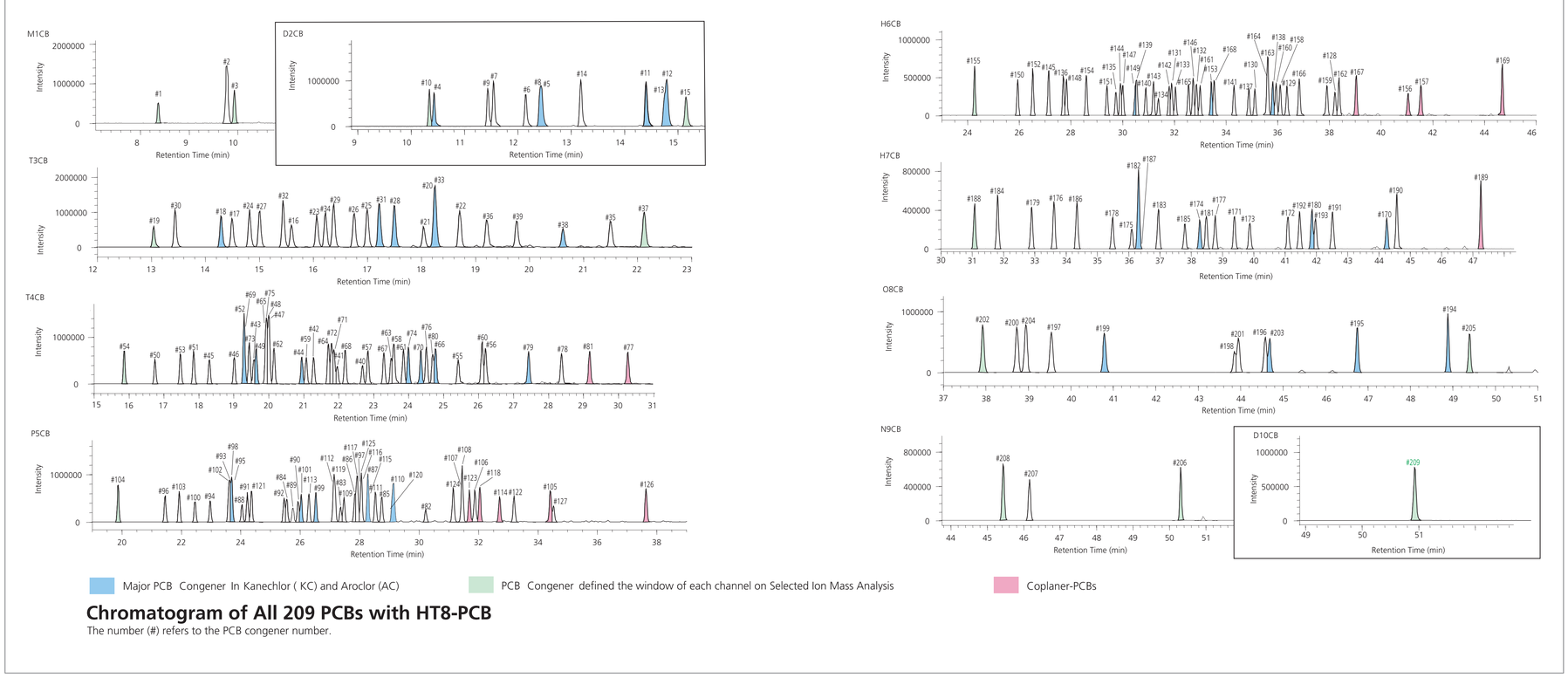


Figure 1. Basic structure of Polychlorinated Biphenyl congeners.



Chromatogram of All 209 PCBs with HT8-PCB
The number (#) refers to the PCB congener number.

Figure 2. Chromatograms of the 209 PCB congeners analysed on HT8-PCB.

THE ANALYSIS

The standard columns used for the analysis of PCBs in environmental samples are the 5% Phenyl Phase or an SGE HT8 carborane Phase. The HT8-PCB capillary column from SGE has been specifically optimised to give the best separation of any column of the 209 congeners.

PCB congeners are non-polar compounds that separate predominantly on boiling point when analysed on non-polar columns such as the standard 5% phenyl columns. Due to the similar structures of many of the PCBs, the boiling points are very similar and many of the congeners are unable to be separated on non-polar columns. The HT8-PCB capillary column gives unique separation of several difficult-to-resolve congeners. The unique partitioning properties of the HT8 capillary column comes from the carborane phase incorporated into the polysiloxane backbone. The carborane phase interacts preferentially with ortho substituted PCBs giving separation of these components to a greater extent than conventional 5% phenyl capillary columns. **Figure 2**, shows the analysis of the complete 209 congeners.

The HT8-PCB can easily resolve the Dioxin like PCBs (77, 81, 126, 169, 105, 114, 118, 123, 156, 157, 167 and 189) from the other congeners, making quantitation easy.

The HT8-PCB column also baseline resolves the very difficult-to-separate congeners 28-31, 34-23 and 163-138 along with the IUPAC seven indicator congeners (IUPAC No's 28, 52, 101, 118, 153, 138 and 180).

The added advantage of the HT8-PCB column is that with the extra polarity and specific interactions with the PCB congeners there is no sacrifice of thermal stability. The HT8-PCB column has a maximum temperature of 360/370°C, comparable or better than most standard 5% phenyl columns commonly used for PCB analyses. Eluting the high boiling PCB congeners on the HT8-PCB capillary column is not a problem.

CONCLUSION

The SGE HT8-PCB capillary column has been specifically designed with the analysis of the 209 PCB congeners in mind. The unparalleled separation of important and extremely difficult to resolve congeners makes the HT8-PCB capillary column the first choice for this type of analysis.

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