

Rapid Analysis of PCBs by Fast GC/TOF-MS

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Introduction

Several kinds of GC Column (eg. DB-5, HT8 etc.) are used for PCB analysis. Total run-time of GC analysis using these columns to obtain employment separation for dominant species (major isomers) of PCBs is about 40 - 60 min. Fast-GC technique is one of a solution for rapid analysis of PCBs. However Fast-GC column requires fast scan speed of detector and MS resolution because of their fast elution (narrow peaks) and co-elution of many compounds. Recently "Time of Flight Mass Spectrometer (TOF-MS)" has been available at a level of routine works. It is possible for TOF-MS to gain fast scan speed and high resolution. In this study, combination of TOF-MS and Fast-GC column has applied to PCBs analysis.

Materials and Methods

TOF-MS (JMS-T100GC, JEOL) attached with Fast-GC column (VF Rapid-MS PCB, Varian) was employed for PCB analysis. Retention orders (column assignment) of all 209 PCB congeners have reported² for "VF Rapid-MS PCB". Analytical conditions of GC/MS are shown in Table-1.

Results

An example (mixture of 62 PCB congeners) of obtained result is shown in *Figure-1*. Numbers of 62 PCB congeners are described by "BZ numbering method¹". Although half-width of each chromatogram peak were extremely narrow (1 - 2 sec), 1 chromatogram peak has 15 - 20 data points according as high-speed scan of TOF-MS detector. Retention time of final elution congener, deca CB's (BZ #209), was about 5.5 minute. Resolving power 5000 (5K) is enough to separate essential congeners from MS fragment caused by high chlorinated major congeners. Results show the combination of TOF-MS and Fast-GC column is suitable technique for rapid PCB measurement.

References

- 1 Ballschmiter, K. and Zell, M. (1980): Analysis of Polychlorinated Biphenyls by Capillary Gas Chromatography, *Fresenius Z.Anal.Chem.*, **302**, 20-31
- 2 Matsumura, T., Seki, Y., Okawa, S., Nakamura, Y., Peene, J., Barmes, M., Zeeuw, J. and Laane, M. (2006): Rapid Analysis for PCBs by Fast GC Column "VF Rapid-MS PCB", *Japan Society for Environmental Chemistry (in Japanese)*, printing

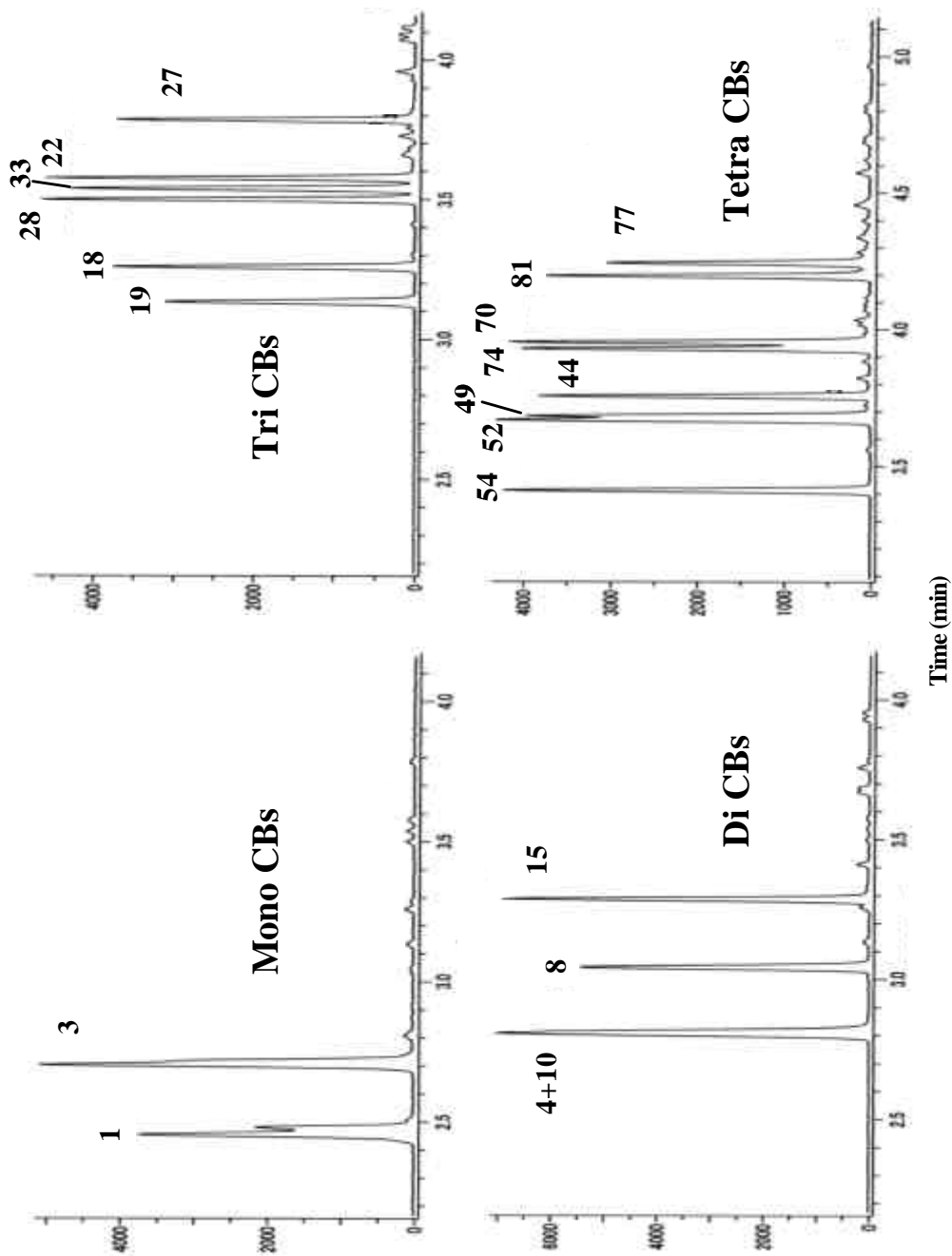


Figure-1. Chromatogram of PCBs Standard Mixture (62 PCBs Congener).

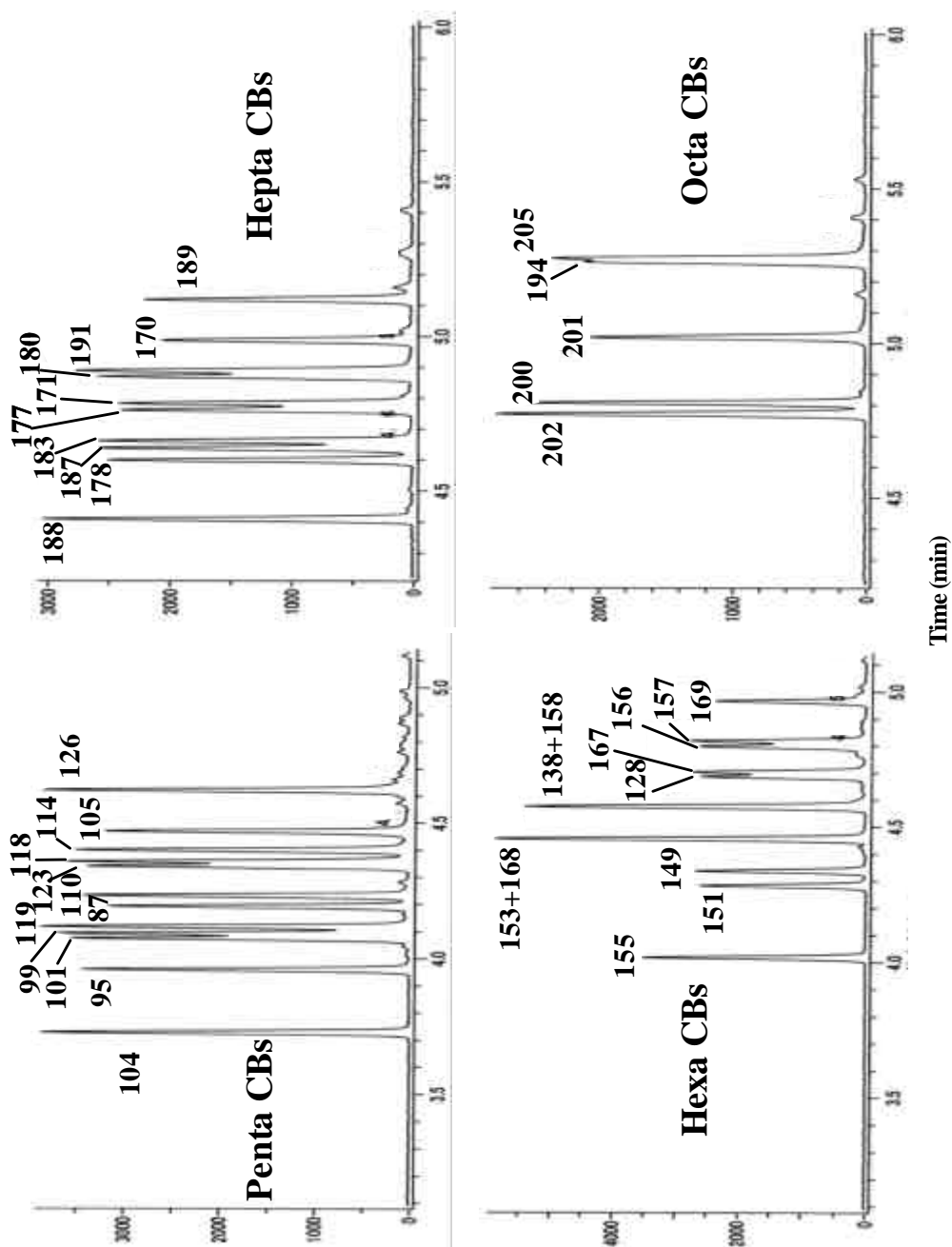


Figure-1. continued.

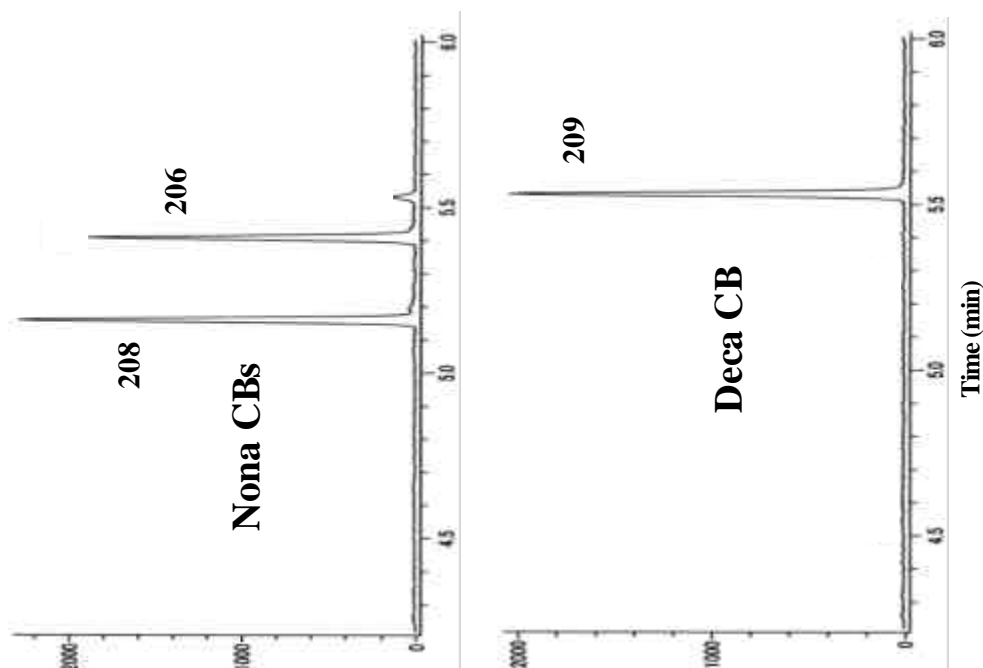


Figure-1. continued.

Table-1. Analytical conditions of “Fast GC/TOF-MS”.

GC: 6890N (Agilent)			
Fast GC Column	VF Rapid-MS PCB (Varian)		
Injection Method	EPC Spiritless		
Purge Time	1.50 min	Purge Flow Rate	50.0 mL/min
Temperature of Injection Port	300 °C		
Gas Flow Volume	1.5 mL/min	Press. of Injection Port	23.54 psi
Ramp of GC Oven Temperature	140°C (1min) - (20 °C/min) – 180 °C (0min) - (5 °C/min) – 200 °C (0min) - (30 °C/min) – 320 °C (1min)		
MS: TOF-MS; JMS-T100GC (JEOL)			
Temperature of GC-MS Transfer Line	300 °C		
Temperature of Ion Source	300 °C		
Range of Measurement MS	35 - 600 m/z		
Electron Ionization Current and Voltage	18 eV, 300 µA		
MS Resolution	5000		
Mass Spectrum Monitoring Rate (Scan Rate)	0.1 sec		