

## Analysis of Polychlorinated Biphenyls (PCBs) by High-Resolution Selected Ion Monitoring (HRSIM)

## Introduction

Polychlorinated biphenyl's (PCBs) have been in use in industry since the early 1900's. These compounds are relatively stable and have properties have led to their use in a variety of applications ranging from electrical insulators to flame retardants. Exposure to PCBs can cause irritation, acne, and rashes. PCBs have demonstrated carcinogenic activity in animal studies. Because of potentially adverse health effects, PCB manufacture was banned in the United States in the 1970's. Because of their stability, PCBs resist degradation and can accumulate in the environment. Quantities of PCBs also exist in transformers and capacitors and hazardous waste sites.

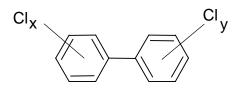


Figure 1. Structure of polychlorinated biphenyl Composition:  $C_{12}H_{(10-x-y)}Cl_{(x+y)}$  [where x+y=10]

Their volatility and thermal stability make PCBs suitable for analysis by GC/MS methods. However, low-resolution mass selected-ion monitoring (LRSIM) is not selective enough to unequivocally identify PCBs in complex mixtures. High-resolution SIM (HRSIM), available with the JEOL *GCmate*, provides additional selectivity which can greatly simplify the identification of PCBs in complex mixtures and environmental samples.

n	$m/z$ ( <sup>35</sup> $Cl_n$ isotope peak)	m/z (M+2 isotope)	n	m/z (M+2 isotope)	m/z (M+4 isotope)
0	154.0783	-			
1	188.0393	190.0364	6	359.8415	361.8386
2	222.0003	223.9974	7	393.8025	395.7996
3	255.9613	257.9585	8	427.7636	429.7606
4	289.9224	291.9195	9	461.7246	463.7216
5	323.8834	325.8805			

n	m/z (M+4 isotope)	m/z (M+6 isotope)	
10	497.6826	499.6797	

Table I. Exact masses for isotope peaks monitored for PCB analysis by SIM

## **GCmate HRSIM Example:**

Crude oil is one of the most complex mixtures known. To demonstrate the use of HRSIM for PCB analysis, a sample of crude oil was spiked with part-per-billion levels of PCBs and analyzed by both low-resolution SIM and high-resolution SIM on the GCmate. The results are shown in Figures 2 and 3. The HRSIM results (Figure 3) show a dramatic reduction in chemical background interferences, making it much easier to identify the PCB's.

154.0T83 Biphenyl	Mar	\$72759
188.0797 1-CI	- kame	236221
190.0364	- kedun	930640
222.0003 2-CI	1 Mar March	
223.9974		185781
255.9613 3-Cl	101 R.	857915
157.8585	, Man	206242
288.9224 4-Cl	8,29 ID11	
291.9195		~31648
323.8834 5-CI	18-31	
325.8805		20005
359.8415 6-CI	11:00	21768
361.8386	· · · · · · · · · · · · · · · · · · ·	17787
383.8025 7-Cl	12.08 10.07	19034
395.7896	· · · bulue	16926
427.7636 8-Cl	36.23 36.12	114768
429.1686		p.c.9.88
461.7246 9-C1	u and the state of	13869
463.7216		_1760
497.6826 10-Cl	1941	25951
499.6797		22089
Time 4 6	8 10 12 14 16 18	20

Figure 2. Polychlorinated biphenyls in Crude Oil LRSIM: Resolution = 500

<sup>6</sup> P		
154.0783 Biphenyl		717945
188.4390 1-CI	Mann	13662
190.0364	ha	100.96
222.0003 2-Cl	P.GL	1542
225.9974		1089
255.9613 3-CI	8.43 20.36 E. A.	4993
257.9585	- la la man	2447
289.9224 4-Cl	948	2245
291.9195		2522
323.8834 5-CI	11:31 13:44 1	1900
335.8905		2746
358.8415 6-Cl	11:33 15:10	2733
361.8386	1	2201
399.8015 7-CI	12.48 19.07	2224
395.7996	1 horas	2152
427.7636 8-CI	14-73 36:12	2112
428.7606	1 1	2055
461.7246 9-CI	u abuan	1898
463.7216	11	2275
497.6836 10-CI	17,21	1969
499,6797		2590
Time 4 6 8	10 12 14 16 18	20

Figure 4. Polychlorinated biphenyls in Crude Oil HRSIM: Resolution = 3000

JEOL USA, Inc. 11 Dearborn Rd., Peabody, MA 01960 Tel: (978)-535-5900 Fax: (978)-536-2205 e-mail: <u>ms@jeol.com</u> WWW: <u>http://www.jeol.com</u>