

## 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.

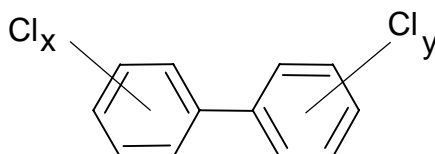


Figure 1. Structure of polychlorinated biphenyl  
Composition:  $C_{12}H_{(10-x-y)}Cl_{(x+y)}$  [where  $x+y=10$ ]

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.

<i>n</i>	<i>m/z</i> ( $^{35}Cl_n$ isotope peak)	<i>m/z</i> ( <i>M</i> +2 isotope)	<i>n</i>	<i>m/z</i> ( <i>M</i> +2 isotope)	<i>m/z</i> ( <i>M</i> +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			

<i>n</i>	<i>m/z</i> ( <i>M</i> +4 isotope)	<i>m/z</i> ( <i>M</i> +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.

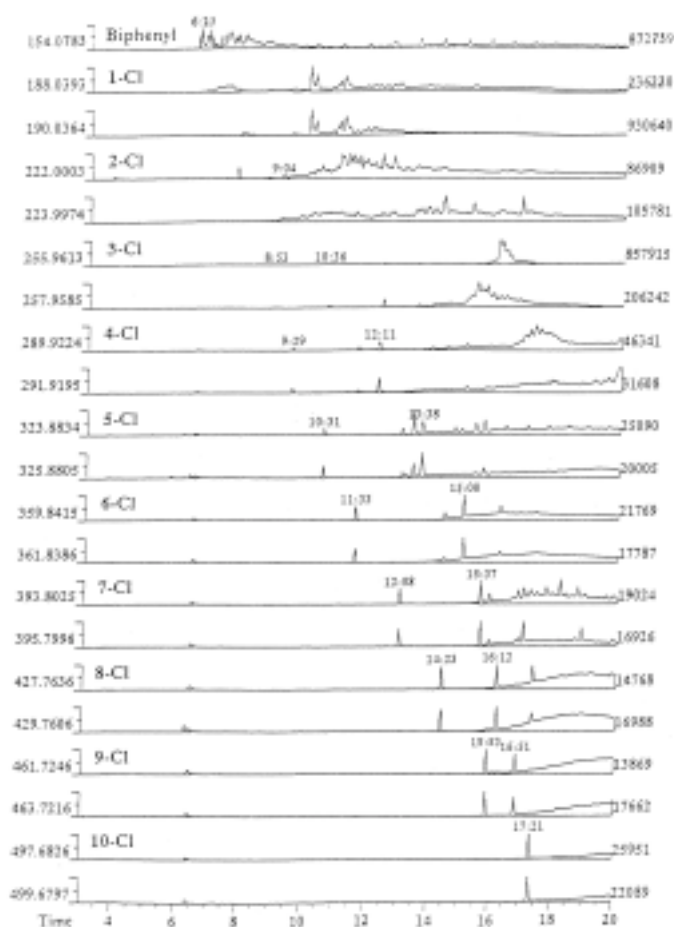


Figure 2. Polychlorinated biphenyls in Crude Oil  
*LRSIM: Resolution = 500*

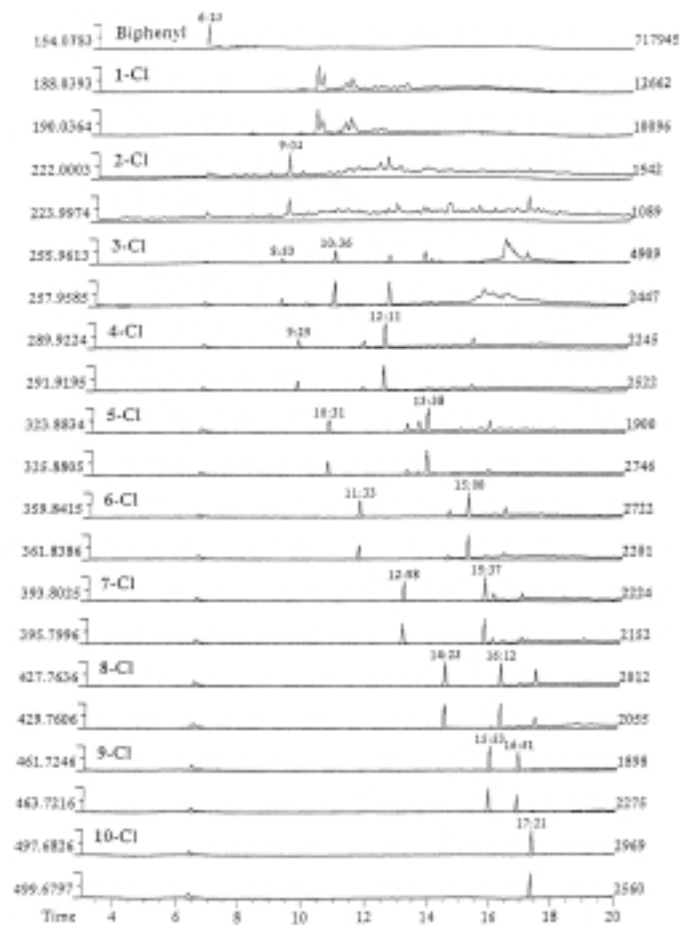


Figure 4. Polychlorinated biphenyls in Crude Oil  
*HRSIM: Resolution = 3000*