

## Development of an expedited field study method for PCBs in sediments and soils using portable GC/MS

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### Introduction

Polychlorinated biphenyls (PCBs) belong to persistent organic pollutants (POP), which are bioaccumulative and resistant to biodegradation. Gas Chromatography/Mass Spectrometry (GC/MS) is the most commonly used technique to quantify and determine PCBs and dioxins from different matrices. Current procedures for assessing environmental PCB contamination on Department of Energy (DOE) property rely on collecting numerous surface and bore samples and sending all samples to DOE certified laboratories for analysis. This approach is extremely expensive (typically  $\geq$  \$1000/sample) and a lengthy turn-around-time (TAT) from the laboratory. Here, we develop a fast, on-site method to analyze PCBs in sediments and soils ( $> 10$  ppm) using a commercial field-portable GC/MS and solid phase microextraction (SPME).

### Method

PCB congeners or Aroclor 1260 (trade name of commercial PCB product) were extracted by SPME and analyzed by portable GC/MS (Torion, American Fork, UT). PCBs 66, 153, 138, 180 and 170 were chosen to investigate the extraction conditions for Aroclor 1260, a known contaminant in the region. To achieve the maximum extraction efficiency, the effects of SPME sorption time, agitation, pH, KMnO<sub>4</sub> and H<sub>2</sub>O were investigated. Different Aroclors such as Aroclor 1254, 1016, 1248, 1232, and 1242 were tested using the same method.

### Preliminary Data

Different SPME sorption time (10 min and 30 min) and the difference of agitation and without agitation during SPME sorption were investigated. The effects of additional KMnO<sub>4</sub> and H<sub>2</sub>O were compared with dry soil samples. To study the effect of pH, two extreme conditions were set: use the water solution with the final concentration of 1 M H<sub>2</sub>SO<sub>4</sub> or 1 M NaOH as the extraction solvent. The longer sorption time and the addition of KMnO<sub>4</sub> and H<sub>2</sub>O help improve the extraction efficiency. No significant difference was found between agitation and no-agitation groups. Compared with using acid or base as extraction solvent, a slight improvement on extraction efficiency was shown by using H<sub>2</sub>O. The GC program was complete within 7 min because of the low thermal mass (LTM) narrow bore (0.1 mm i.d.) column. Different Aroclor spikes can be distinguished by some obvious differences between the total ion current patterns in the resulting chromatograms. Extracted ion chromatograms can be used to help identify specific congeners (or co-eluting structural isomers), which can be used to manually differentiate

between the different Aroclors. Preliminary site demonstration for Aroclor 1260 10 ppm in soil standard was confirmed in a total analysis time of ~45 min (including sample preparation, 30 min SPME extraction and 6.5 min GC/MS separation/detection). The value of correlation coefficient  $r^2$  of the calibration curve was 0.93.

**Novel Aspect**

Simple, fast, on-site method for the field study of PCBs

**Note**

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