

CHAPTER III
**DETERMINATION OF AROCLOR 1242 CONCENTRATION IN
AN AGED CONTAMINATED SOIL**

3.1 ABSTRACT

Aroclor 1242 concentration was determined for an aged soil that was reportedly contaminated in the early 1970's. Aroclor 1242 concentration was determined by EPA Method 3550 for surface soil from two different containers, collected from the same site. The concentration of Aroclor 1242 was determined to be 1739 and 1521 mg/kg, which was comparable to the reported value, 1900 mg/kg.

3.2 INTRODUCTION

Polychlorinated biphenyls (PCBs) are ubiquitous environmental contaminants that have attracted great concern in the past few decades. PCBs were first synthesized in 1864 (WHO, 1993) and widely used in the United States between 1929 until their manufacture was banned in 1977 (Erickson, 1986; Nies and Vogel, 1990). Due to the widespread use of PCBs and improper disposal practices, a significant amount of PCBs have been introduced into the soil and sediment environment. Because their hazardous nature has only recently been understood, PCBs have been disposed of over the years, without any precautions being taken.

PCBs have a very stable molecular structure consisting of a biphenyl nucleus carrying from 1 to 10 chlorine atoms (Bedard et al., 1987; Crine, 1988; Hutzinger et al., 1983; Mousa et al., 1996; Quensen III et al., 1990). Because of their stable molecular structure and hydrophobicity, PCBs are resistant to chemical decomposition and biodegradation. As a result, they persist in the environment for long time periods without any significant change. After 18 years of efforts to clean the PCBs, millions of lbs of PCBs still exist in the environment.

The objective of this study was to determine the concentration of Aroclor 1242 in an aged surface soil, contaminated in the early 1970's.

3.3 MATERIALS AND METHODS

3.3.1 PCB Contaminated Soil

The PCB contaminated surface soil was provided by BioSystems Technology, Inc. (Blacksburg, VA). The aged contaminated soil was reported to have an Aroclor 1242 concentration of 1900 mg/kg. The soil was sieved through a 2mm sieve, stored in airtight containers and refrigerated at 4° C until use. The soil had 10% moisture content.

3.3.2 Chemicals

Na₂SO₄ was purchased from Fisher Scientific Co. (Fair Lawn, NJ). Aroclor 1242 standard was purchased from Supelco (Bellefonte, PA). All other chemicals were reagent grade.

3.3.3 Extraction of Aroclor 1242 from Soil

To 10 g of soil in a beaker, 60 g of Na₂SO₄ and 100 mL of methylene chloride : acetone (1:1, v:v) were added. Aroclor 1242 was extracted from the soil using the EPA Sonication extraction procedure (EPA Method 3550).

An Ultrasonic Cell Disrupter (Ultrasonic, Inc., Model W-385; 475 watt) Sonicator with a Tapped Disrupter Horn (No. 207 3/4"), equipped with a titanium tip was used for the extraction. The bottom surface of the tip of the #207 3/4" disrupter horn was placed about 1/2" below the surface of the solvent in the beaker, but above the soil layer. The soil slurry extraction mixture was sonicated for 3 minutes, with output control knob set at 50%. Extracts were then decanted and filtered through Whatman No. 41 filter paper into a clean flask. The extraction was repeated twice more with 100 mL of 1:1 methylene chloride : acetone. After the third time, the entire sample was poured into the Buchner funnel, rinsed with extraction solvent, and filtered into the flask.

A Kuderna-Danish (K-D) apparatus was assembled by attaching a 10-mL graduated concentrator tube (Kontes K-570050-1025) to a 500-mL evaporator flask (Kontes K-570001-0500). The extracted solvent was poured into the K-D concentrator. The extractor flask was rinsed with more of the extraction solvent to make sure that all of the extracted PCB was transferred into the K-D concentrator. To the evaporative flask, 2-3 clean boiling chips (solvent extracted, approximately 10/40 mesh) were added. A three-ball macro Snyder column (Kontes K-503000-0121) was attached to the evaporator flask. The Snyder column was prewetted by adding about 1 mL methylene chloride to the top. The K-D apparatus was placed on a hot water bath (80-90° C) with the concentrator tube partially immersed in hot water and the entire lower rounded surface of the flask bathed with hot vapor. The vertical position of the apparatus and the water temperature was adjusted accordingly, to complete the concentration in 15-20 minutes. When the apparent volume of liquid reached 1 mL, the Snyder column was removed and 100 mL of hexane (exchange solvent) and a new boiling chip was added to the K-D concentrator, and the Snyder column was reattached. The extract was concentrated by raising the temperature of the water bath, to maintain proper distillation. When the liquid reached an apparent volume of approximately 5 mL, the apparatus was removed from the water bath, and allowed to drain and cool for 10 minutes. The Snyder column was removed and its lower joint was rinsed into the concentrator tube with approximately 0.5 mL of hexane. This concentrated extract was further diluted with hexane to reach a concentration of one part per million (ppm).

3.3.4 Analysis by GC-ECD

In preparation for GC-ECD analysis, the extracted PCB samples were transferred to small auto sampler glass vials capped with Teflon-lined lids. Using a solvent flush program, 2 μL of the sample was injected into a Hewlett-Packard Model 5890 Series II gas chromatograph equipped with an automatic sampler, an electron capture detector (ECD), and fitted with a HP-5 capillary column (30 mm by 0.53 mm internal diameter, 0.88 μm film). Gas chromatographic conditions were based on EPA Method 8080. The injector and detector temperatures were maintained at 200°C and 290°C, respectively. The oven program consisted of an initial temperature of 150°C, an increase rate of 5°C/min to 280°C, and maintenance at that temperature for 10 minutes. The flow rate of the carrier gas, helium, was 60 mL min⁻¹. Total Aroclor 1242 concentration was

determined by comparing the area under the chromatograms of the sample with the area of a 1 ppm Aroclor 1242 standard and multiplying with the multiplication factor.

3.4 RESULTS AND DISCUSSION

The Aroclor 1242 concentration in the contaminated soil was reported to be 1900 ppm (mg/kg). The above experiment was performed with soil from two different containers, reported to have the same Aroclor 1242 concentration (1900 mg/kg). This study, however, showed different results. For one of the 10 g samples from one container, the Aroclor 1242 concentration was calculated to be 1739 mg/kg while for the other sample from the second container, it was determined to be 1521 mg/kg.

There could be a few possible explanations for why the concentrations I found were different from the reported value. The first thing to consider would be the fact that this soil is an aged soil. It has been contaminated about 25 years ago and has been sitting there. Also, the only information I was provided about the soil was that it was contaminated with Aroclor 1242 in the early 1970's and the concentration was 1900 mg/kg. But, it is not known when and under what conditions the soil was tested. It is not known who determined the Aroclor 1242 contamination level in the soil, and how many years ago was it reported. Also, this difference in concentration could also be due to differences in the analytical methods used.

I found two different concentrations for Aroclor 1242 in the soil obtained from two different containers, but collected from the same site. The soils collected were surface soil and could have been obtained from different parts of the site. These results also suggest that PCB content of the soil varied from sample to sample.

It is concluded from this study that Aroclor 1242 concentration in the contaminated soil was determined to be slightly different than the previous reported value. Also, the soils sampled from different parts of the site had different concentrations of the contaminant. These values were not significantly different from one another and were comparable to the reported value.

3.5 REFERENCES

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