「Application Note」

Analysis of Polychlorinated Biphenyls (PCBs) in Soil Samples by ChroZen GC-μECD

- GC Application

Abstract

PCBs(Polychlorinated Biphenyls) belong to a group of chlorinated organic compounds and had been widely used in various industrial and commercial applications such as heat transfer fluids, plasticizers, dyes, carbonless copy papers, etc, due to their chemical stability and electrical insulating properties.

However, PCBs were classified as persistent organic pollutants and the manufacturing and uses of PCBs were banned because of their environmental toxicity and adverse human effects. Their poor biodegradability leads the human exposure to PCBs remaining in our environment.

Thus, PCBs, as major environmental pollutants, are strictly regulated in various fields including soils and water-related applications.

In this study, the analysis of PCBs in soils was conducted by ChroZen GC-μECD referring to the Examination of Soil Contamination (PCBs-Gas Chromatography) by Korea Environment Corporation.

Instruments and Software

· ChroZen GC/µ-ECD

Item	Description	Part No.
Oven	ChroZen GC Mainframe Assembly with UPC Detector Board Unit	6701012502
Inlet	Capillary Inlet Assembly for ChroZen GC	6701012550
Detector	µ-ECD Assembly for ChroZen GC	6706620010
CDS	YL-Clarity software for single instrument of YL GC	5301011020
Column	DB-5 (30m, 0.25 mm, 0.25 µm)	-
Install. Option	Start-up kit includes (Without GC Capillary Column)	1601011110
ACC	Big Universal Trap, 1/8" fttgs, Nitrogen	RMSN-2

Fig 1. ChroZen-µECD

Preparation of Soil Samples

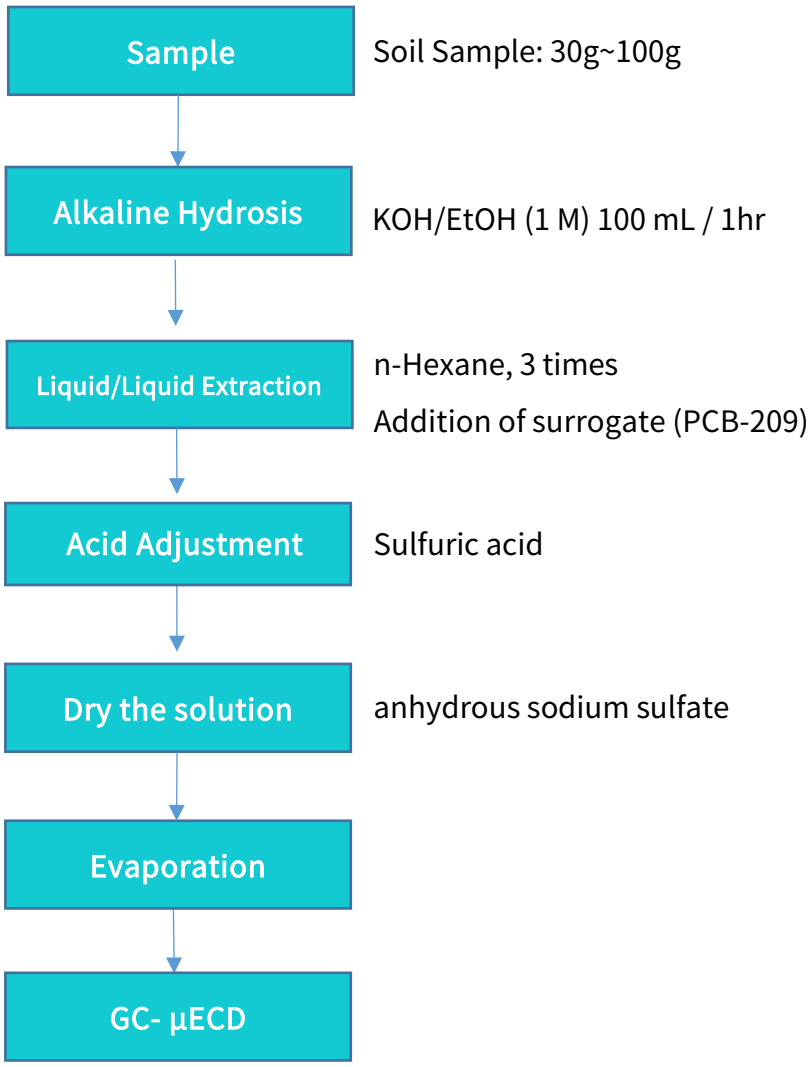

Table 1. Preparation of Soil Samples

Set the sample amount depending on the sample matrices. Add 100 mL of KOH/EtOH(1M) into the sample for alkaline hydrolysis and extract the sample using liquid/liquid extraction by Hexane. Repeat this extraction 3 times to collect the hexane layer and add PCB-209 as a surrogate. After this procedure, add sulfuric acid to remove organochlorine or organophosphorus residues. Repeat this procedure until the color of sulfuric acid turns to transparent. Dry the sample by anhydrous sodium sulfate for collection.

Standards

PCBs Standards (Aroclor-1242, 1248, 1254, 1260)

In case of not using standard mixture, mix each standard PCB in constant mixing ratio.

Ex) Aro-1242+Aro-1254 (1:1)

Aro-1242+Aro-1260 (1:1)

Aro-1254+Aro-1260 (1:1)

Aro-1242+Aro-1254+Aro-1260 (1:1:1)

Method of analysis

Table 2. GC-µECD Conditions

GC-µECD conditions	
Column	DB-5 (30m x 0.25mm x 0.25µm)
Inlet	Temperature: 270°C Spilt Ratio: 20:1 Injection Volume: 1µL Carrier Gas: N_2 (99.999 %)
Oven	Oven temperature program : 100°C → 20°C/min → 300°C(5 min)
Detector	µECD
	Temperature: 350℃
	Current Value: 20

Result

1 ppm of each standard Aroclor-1242, 1248, 1254, 1260 and mixture of 4 Aroclor were analyzed by ChroZen GC- µECD and each chromatogram is as below.

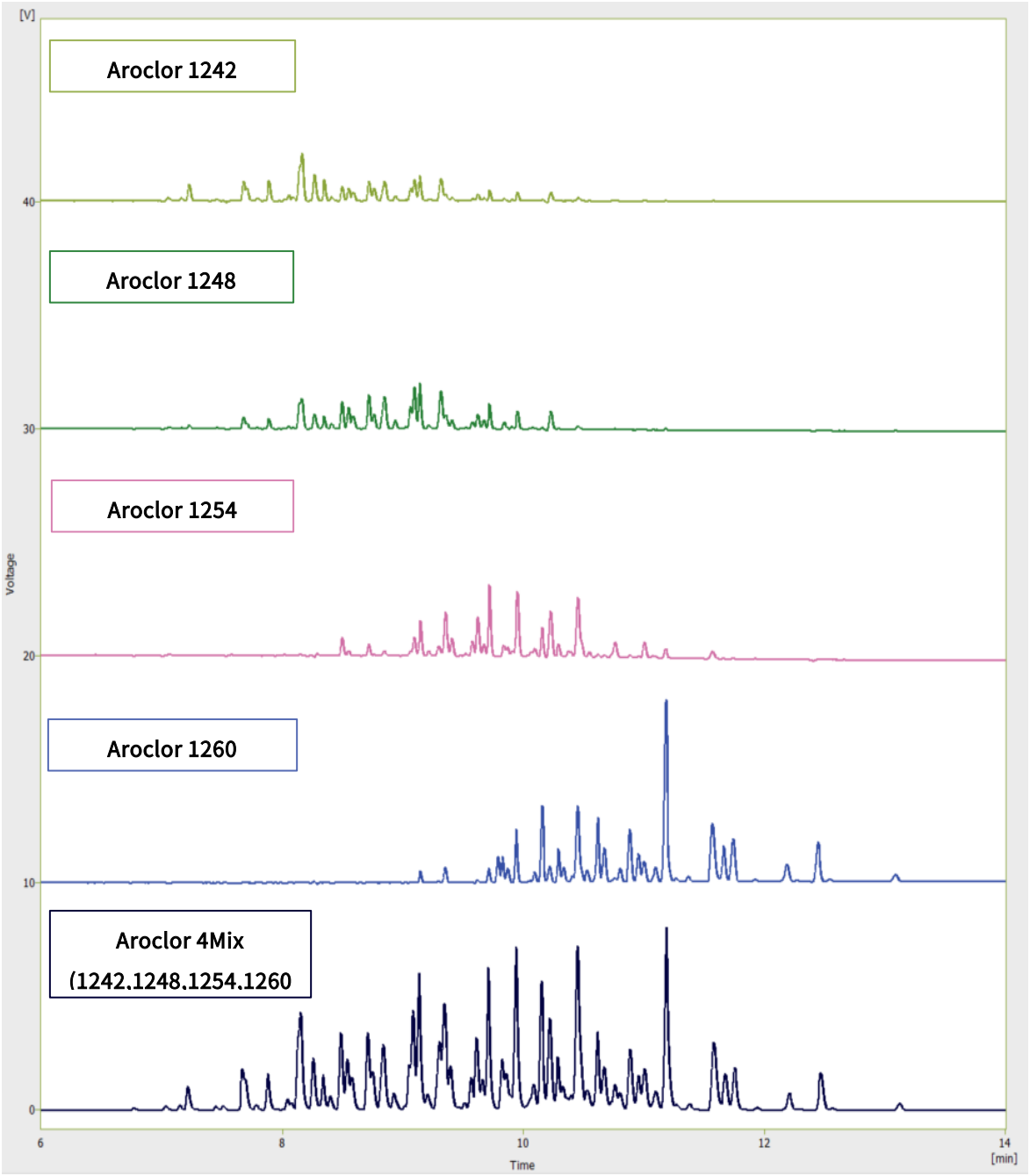

Fig 2. Chromatogram of Aroclor-1242, 1248, 1254, 1260 and Aroclor Mix at 1 ppm

The calibration curve was generated with Aroclor 4 Mix at 10, 50, 100, 250, 500 ppb and the correlation coefficient was calculated to 0.9998106.

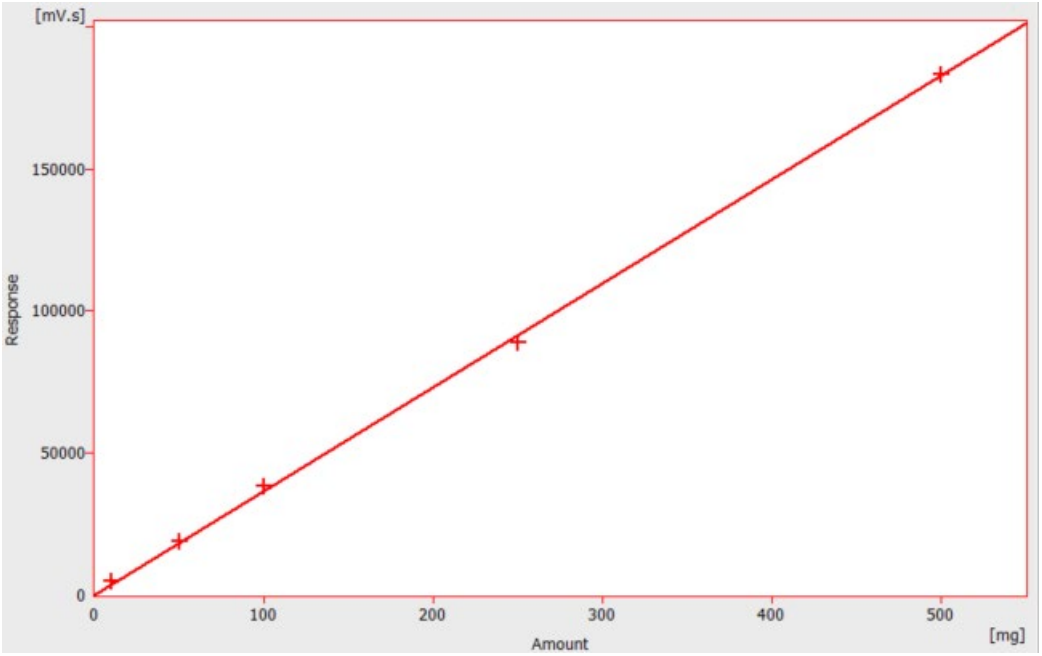

Fig 3. Calibration curve for PCBs

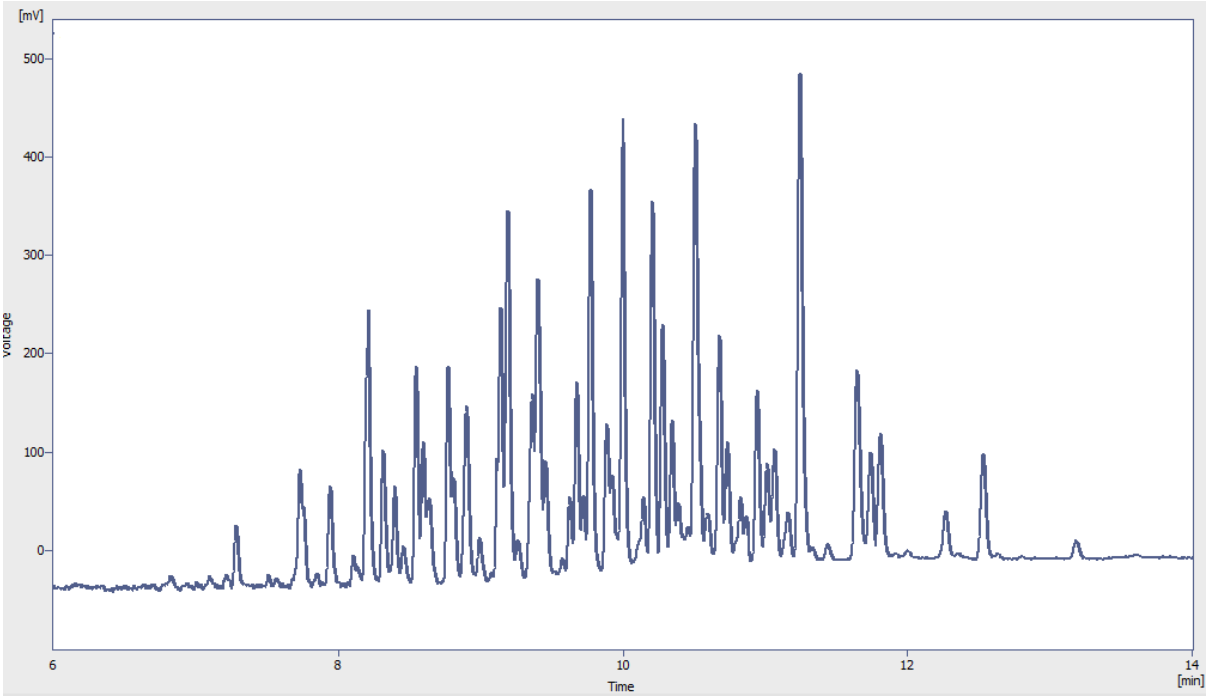

Fig 4. Chromatogram (Aroclor Mix 50ppb)

Conclusion

In this study, the determination of PCBs (Polychlorinated Biphenyls) in soils was conducted by ChroZen GC-µECD referring to Examination of Soil Contamination ES 07554.1b (PCBs-Gas Chromatography).

The correlation coefficient was greater than 0.999 with Aroclor 4 mix standard in the range of 10 ppb to 500 ppb and this ensures data reliability.

As the result, ChroZen GC-µECD can determine PCBs in wide range of concentration with the verified reliability.

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Reference

- Examination of Soil Contamination ES 07554.1b (PCBs-Gas Chromatography)

- Risk Assessment of PCBs Exposure by National Institute of Environmental Research