Dioxin determination on air filter samples

SpeedExtractor E-914:
Dioxin determination on air filter samples using Pressurized Solvent Extraction (PSE)

Polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are persistent organic pollutants (POPs) reported on the Stockholm Convention black list. Dioxins and furans are unwanted by-products of combustion released from chemical manufacturers and incinerators, introduced to the environment through the air emissions.

1. Introduction

To analyze dioxins intensive pretreatment methods are required, including extraction, purification and condensation prior to analysis by GC/MS. Although Soxhlet extraction is used in the regulated methods, it takes more than 16 hours and it becomes the “bottleneck” procedure. Since pressurized solvent extraction (PSE) is expected to shorten the extraction time, it was investigated whether PSE is feasible for dioxin analysis in air.

2. Experimental

Equipment: SpeedExtractor E-914, glassware for Soxhlet extraction

Samples: Quartz fiber filter paper (QFF) and Polyurethane foam (PUF)

Sampling: The filters were placed in a high volume air sampler for 3 days, (HV-700, Sibata, Tokyo, Japan) on the roof of Osaka City Institute of Public Health and Environmental Science in June 2012, with a flow rate of 700 L/min. The filters were placed into the extraction cells as shown in Fig 1.

Fig 1: PUF sample loaded into extraction cell [1]

The extraction was carried out with the SpeedExtractor E-914. The method parameters are shown in Table 1.

Table 1: Extraction parameters for dioxin and furan determination using PSE

Sample	QFF	PUF
Temperature	100 °C	80 °C
Pressure	100 bar	100 bar
Cell	40 mL	120 mL
Solvent	Toluene (100%)	Toluene (100%)
Vial	240 mL	240 mL
No. of cycles	3	3
Heat-up	3/1/1 min	5/1/1 min
Hold	3/3/3 min	3/3/3 min
Discharge	3/3/3 min	3/3/3 min
Flush with solvent	2 min	3 min
Flush with gas	6 min	6 min
Total time	51 min	53 min

Analysis: Target substances for the dioxin and furan analysis are 4-8 Polychlorinated dibenzo-*p*-dioxins/dibenzofurans (PCDD/ PCDFs) and 12 non-ortho and mono-ortho coplanar-PCBs (Co-PCBs). The workflow for the determination is shown in Fig. 2.

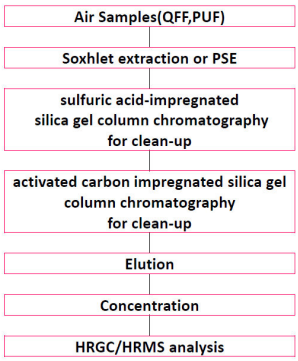

Fig 2: Workflow for the target compounds determination [1]

The samples were also extracted with a Soxhlet extraction method for 16 h.

3. Results

The results of the dioxin determination in air samples are shown in Fig 3.

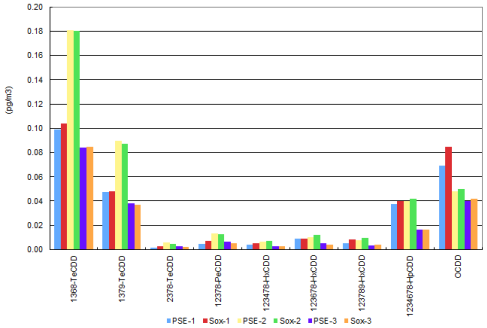

Fig 3: Result of PCDD determination in air samples

4. Conclusion

The determination of PCDD/PCDFs with the SpeedExtractor E-914 provides reliable and reproducible results. The PSE method takes only 53 min compared to the 16 h taken for the Soxhlet extraction. The speed is increased further as up to 4 samples can be extracted in parallel.

5. Acknowledgement

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5. References

[1] Study on Extraction Method of Dioxins and Perfluorinated Organic Compounds (PFOS/PFOA) in Air by use of Pressurized Solvent Extraction (PSE), K. Iwamoto, T. Tojo, A. Yamamoto, Dioxin Conference (Poster), Daegu, 2013.

Operation manual of SpeedExtractor E-914