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THE NEW APPROACH TO MEASURE THE TOXICITY OF DIOXINS IN WASTE GAS USING THE ECOASSAY DIOXIN ELISA KIT AND THE DIOANA FILTER

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Introduction

Dioxins (polychlorinated dibenzo- *p*- dioxins, polychlorinated dibenzofurans and coplanar-polychlorinated biphenyl) belong to the class of the most hazardous environmental contaminants of current serious public concern. Certainly they are one of the by- products from the process of waste disposal, which are characterized by high environmental stability and diverse biological activities, especially strong toxicity and carcinogenecity. Presently, the toxicity of dioxins in waste gas is measured using high- resolution Gas Chromatography/high- resolution Mass Spectrometery (GC/MS) by detecting all isomers assigned with a TEF value (2,3,7,8- TeCDD Toxicity Equivalency Factor) after collecting sample by using a impinjer. GC/MS requires high cost and a long turnaround time, although it can detect dioxin isomers with high sensitivity and the collecting method using a impinjer requires complicated extraction procedures. Consequently, it is very difficult to measure the toxicity of dioxins in waste gas routinely, but it is more reasonable to measure the toxicity in waste gas using an immunoassay method and a new convenient collecting method with a low cost and short turnaround time. The Eco Assay® Dioxin ELISA kit (ELISA kit) is one of immunoassay detection method based upon the competition assay and the DiOANA® filter is new type filter that will be able to catch dioxins as well as an impinjer[1)] . So, it is especially useful for screening the dioxins in the waste gas using the ELISA kit and the filter. In this paper, we will report the correlation between the ELISA kit and GS/MS, measuring the toxicity of dioxins contained in the waste gas that was collected by the DiOANA® filter.

Methods and Materials

Sample: The number of samples used for this report was 30.
Method for collecting the waste gas: According to the Method for determination of tetra-through octa-chlorodibenzo-p-dioxins, tetra-through octa-chlorodibenzofurans and coplanar polybiphenyls in stationary source emissions, we collected the waste gas from the various type of incinerator (Figure 1).
Method for extracting method and clean-up operation: According to JIS K 0311:1999, we first extracted the dioxins from the waste gas and cleaned-up the sample(Figure 2).
Immunoassay Procedure: Procedure of the Eco Assay® Dioxin ELISA kit is shown in Figure 3.

Results and Discussion

The level of dioxins in waste gas that were measured by GC/MS and the ELISA kit are shown in Table 1. The correlation between the toxic equivalents (TEQ) of GC/MS and the ELISA kit data (DEQ) are summarized in Figure 4. This figure details the significant correlation expressed by gradient of 2.917 with a correlation coefficient of 0.979. One justification of the correlation test revealing meaningful results, is that the crossreactivity of antibody using in this ELISA kit are very similar to the WHO TEF values of dioxins [2)].

Conclusion

These results clearly show the validity for the measurement of dioxins using the ELISA kit and the DiOANA filter. In addition, this presents a new method for measuring dioxins in waste gas.

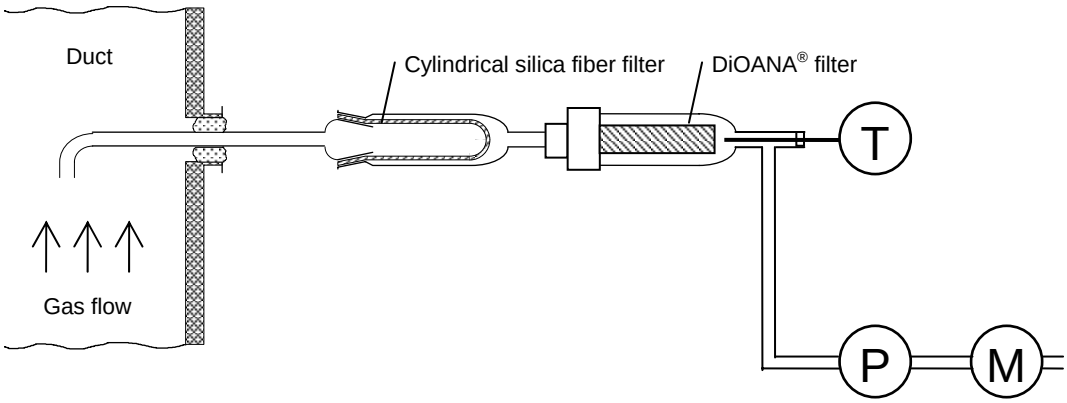

Figure 1. Schematic diagram of method for collecting waste gas with DiOANA® filter.

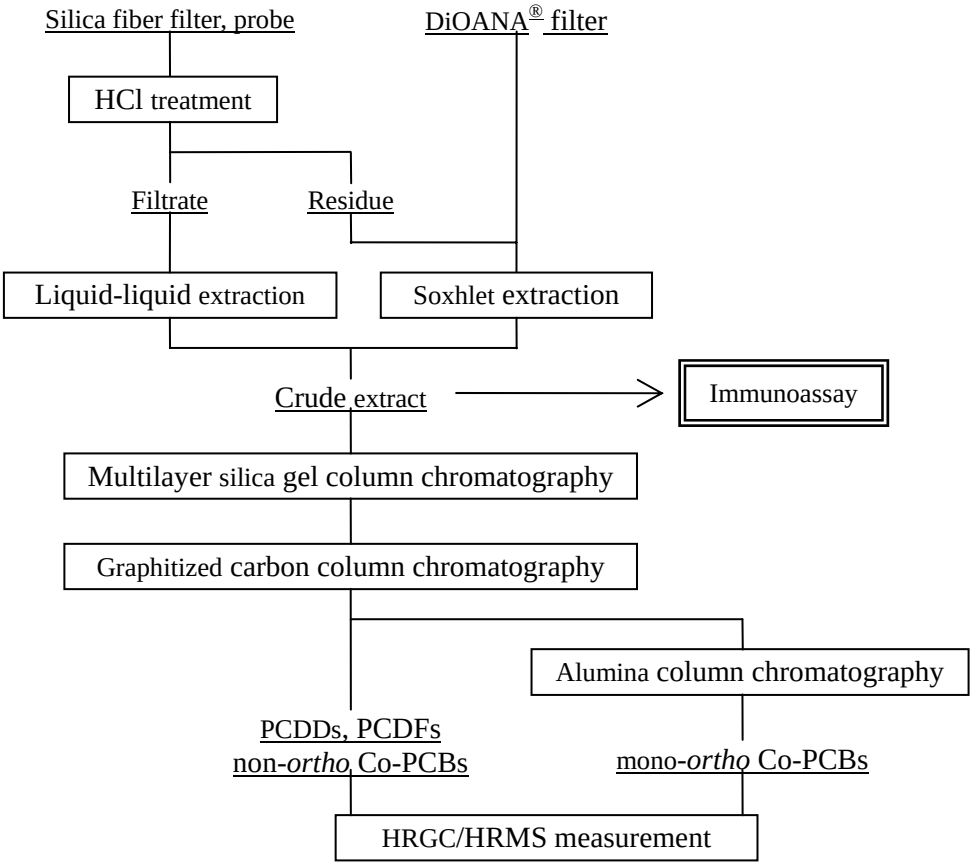

Figure 2. Flow diagram of extraction and cleanup for GC/MS measurement.

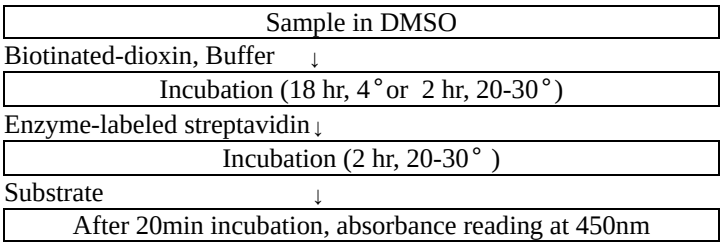

Figure 3. Procedure of the Eco Assay® Dioxin ELISA kit

Table 1 The level of dioxins in waste gas

Sample No.	GC-MS (ng-TEQ/mL)	ELISA (ng-DEQ/mL)	Sample No.	GC-MS (ng-TEQ/mL)	ELISA (ng-DEQ/mL)
1	0.013	0.01	16	0.041	0.21
2	0.029	0.00	17	0.060	0.42
3	0.066	0.02	18	0.084	0.64
4	0.11	0.50	19	0.10	0.53
5	0.25	1.75	20	0.16	0.38
6	0.45	1.87	21	0.23	0.51
7	1.0	5.87	22	0.37	0.41
8	1.7	6.77	23	0.49	2.41
9	4.4	10.55	24	0.70	1.58
10	9.1	28.19	25	0.97	0.41
11	0.0073	0.27	26	1.4	3.73
12	0.011	0.53	27	1.9	9.16
13	0.014	0.29	28	2.3	5.41
14	0.020	0.24	29	3.6	8.88
15	0.029	1.15	30	5.8	17.09

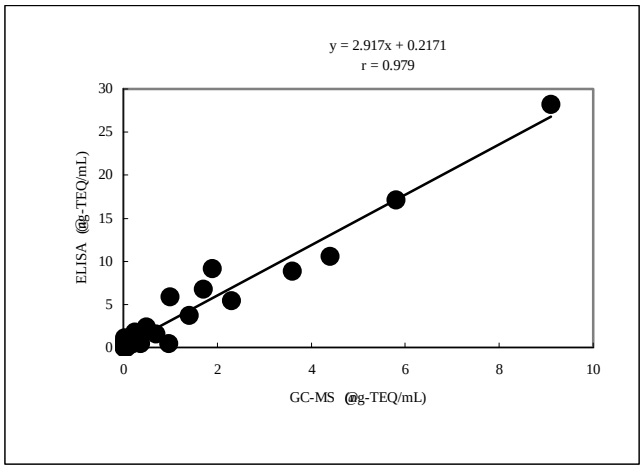

Figure 4 The Correlation between GC/MS and the ELISA kit

References

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2. Tsukasa Kodaira, Yasuteru Usuki, Biomedical Research, under pressing