

BIOACCUMULATION OF PCDDs/PCDFs IN MEAT SAMPLES

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Introduction

Polychlorinated naphthalene (PCNs), polychlorinated biphenyl (PCBs) and terphenyls (PCTs), polybrominated biphenyls (PBBs), dibenzo-p-dioxine (dioxins), and dibenzofurane (furanes) comprise a group of structurally related aromatic compounds of considerable environmental concern because of their fat solubility, resistance to biological degradation, bioaccumulation potential, and high toxicity of particular congeners[1]. The PCDDs/PCDFs are two series of tricyclic, almost planary aromatic compounds. Because of the extreme toxicity of some PCDDs/PCDFs isomers as well as the large variation in toxicity between closely related congeners, highly selective, specific, and sensitive analytical techniques are required for the measurement.

Determination of concentration and distribution of PCDDs/PCDFs in meat samples are indispensable because food is the major exposure of PCDDs/PCDFs in human. The level of PCDDs/PCDFs in food(meat, fish, shell fish, milk and so on) are reported in many countries[2,3,4].

In this study, the levels of PCDDs/PCDFs in pork, which imported from three different countries(A, B, C) were measured, and examined the difference of distribution.

Experimental Methods

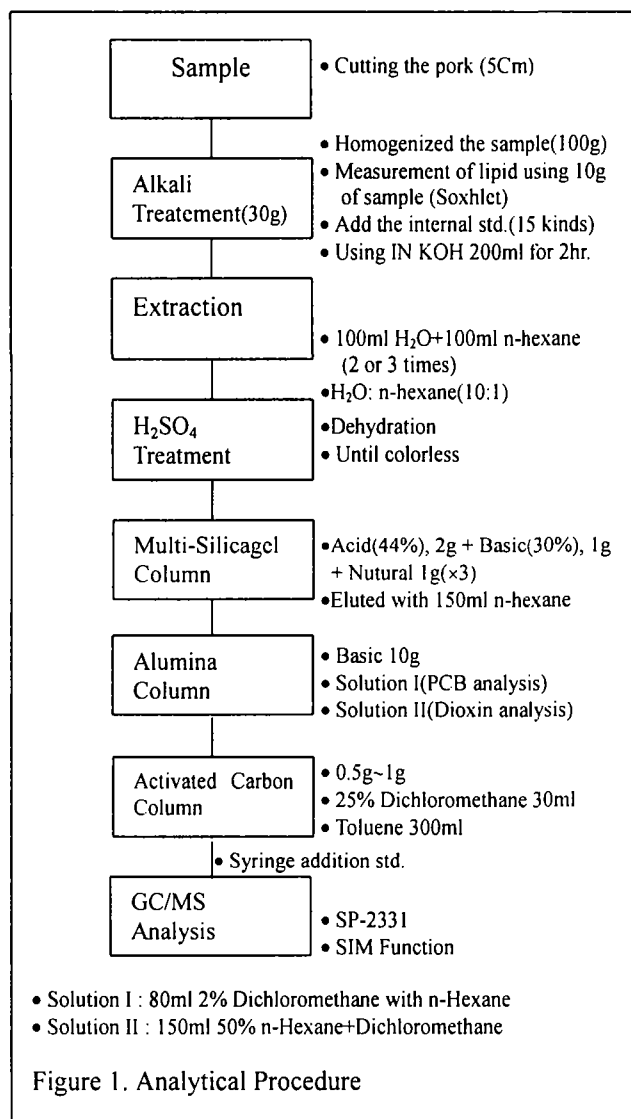
PCDDs/PCDFs Analysis : The pork samples cut into less than 5mm, and samples were homogenized, alkali treatment, sulfuric acid treatment, cleanup process and GC/MS analysis. In acid treatment, the 5ml of acid added to the sample, shaking for 20 min, and stopping for 40 min. After acid treatment, the pH of extract sample was controlled to natural. The

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Table 1. Analytical Conditions

	PCDDs/PCDFs
GC/MS	Micro Mass Co., Model Autospec
Inject Temp.	Ultima 250 °C
Colum	SP-2331 (60m × 0.32mm ID × 3.0 μm)
Oven Temp.	120 °C (3min) → 200 °C (10 °C/min, 3min) → 265 °C (3 °C/min, 15min)
Carrier Gas	He, 2.5 ml/min
Injection Mode	Splitless
Ion Mode	EI
Ionization Energy	36eV
Ion Source Temp.	260 °C
Resolution	10,000
Monitoring	SIM, 4 Function

analytical condition is represented in Table 1, and the analytical procedure shown in Figure 1.



Lipid Analysis : 10g of homogenized sample mixed with 30~40g of Na₂SO₄, for stopping 12~24 hr, and the soxhlet extraction performed to dichloromethane: hexane(1:1).

Analytical Data Presentation : The detection limit of the analytical data were represented to 0.005pg/g for tetra- and penta-, 0.010pg/g for hexa- and hepta-, and 0.02pg/g for octa-PCDDs/PCDFs.

Results and Discussion

Bioaccumulation of PCDDs/PCDFs : The fourteen samples imported three different countries were analyzed to examine the concentration of PCDDs/PCDFs. The average concentration of PCDDs/PCDFs represented in Table 2. As shown in Table 2, the detected concentration was surveyed 1.553~2.017 pg/g and 0.038~0.063 pg-TEQ/g. This detected concentration similar to other country's reported data such as 0.059~1.3 pg-TEQ/g for U.S.A[5,6], 0.092 pg-TEQ/g for Japan[7], 0.25~0.43pg-TEQ/g for Netherlands[6], 0.073 pg-TEQ/g for Germany[6] and so on.

Distribution Patterns of PCDDs/PCDFs : The distribution of dioxin in meat sample showed the different patterns of environmental samples. In incinerator, the seventeen kinds of 2,3,7,8-substituted isomer detected, but the selected samples were mainly detected 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 2,3,7,8-TCDD, 1,2,3,4,6,7,8-HpCDD and OCDD. Especially, OCDD count for 70% of total detected PCDDs/PCDFs concentration, therefore the high chlorinated compounds were mainly accumulated as shown in Figure 2. These can be explained to the octanol-water distribution coefficient of

POPs IN FOOD-POSTER

Kow. Generally, the higher Kow represented that the compound could be more accumulated to samples(fat, soil etc.). The Kow values of the hepta- and octa-chlorinated PCDDs/PCDFs were reported 7.92~8.20, and Kow value of OCDD was reported 8.20, which is the highest value of Kow. The Kow of tetra-PCDDs/PCDFs values were reported 4.42~6.53, and penta- and hexa-PCDDs/PCDFs were reported 6.92~7.80[9].

Therefore, we could predict that the OCDD could be much more accumulated the samples comparing to other congeners, and these reported data agreed to our experimental data as mentioned in Table 2.

Table 2. Distribution of 2,3,7,8-Substituted Isomer in Meat Samples

2,3,7,8-Isomer	Country(pg/g)		
	A	B	C
2,3,7,8-TCDF	ND	ND	ND
1,2,3,7,8-PeCDF	ND	ND	ND
2,3,4,7,8-PeCDF	0.038	0.018	0.065
1,2,3,4,7,8-HxCDF	0.047	0.077	0.072
1,2,3,6,7,8-HxCDF	0.014	0.012	0.009
2,3,4,6,7,8-HxCDF	ND	ND	ND
1,2,3,7,8,9-HxCDF	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.128	0.105	0.107
1,2,3,4,7,8,9-HpCDF	ND	ND	0.008
OCDF	ND	ND	ND
2,3,7,8-TCDD	0.006	0.003	0.009
1,2,3,7,8-PeCDD	ND	ND	0.011
1,2,3,4,7,8-HxCDD	ND	0.003	0.020
1,2,3,6,7,8-HxCDD	ND	0.005	0.018
1,2,3,7,8,9-HxCDD	ND	ND	ND
1,2,3,4,6,7,8-HpCDD	0.112	0.140	0.128
OCDD	1.271	1.193	1.578
(PCDFs) pg/g	0.227	0.212	0.253
(PCDDs) pg/g	1.389	1.341	1.764
(PCDDs+PCDFs) pg/g	1.161	1.553	2.017
(PCDDs+PCDFs) pg-TEQ/g	0.038	0.045	0.063
(PCDDs+PCDFs) pg-TEQ/Fat g	0.099	0.122	0.154

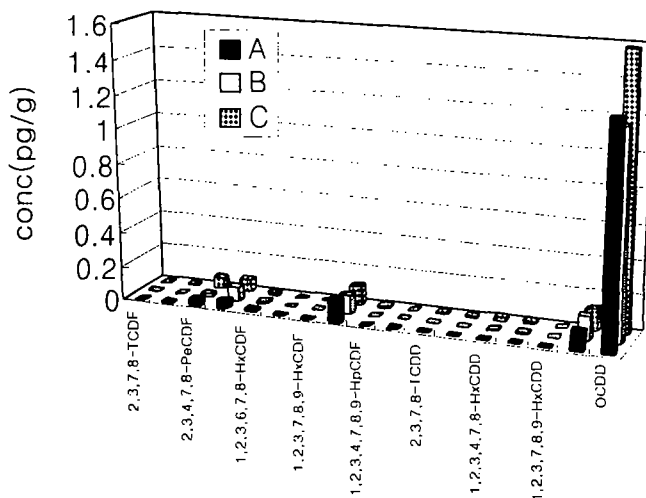


Figure 2. Distribution of PCDDs/PCDFs

References

1. Cold Spring Harbor Laboratory, Biological Mechanisms of Dioxin Action, edited by Poland, A. and Kimbrough, R. D., 1984.
2. Bech, H., Drob, A. and Mather, W., *Chemosphere*, 35(1992), 1539.
3. Birmingham, B., Gilman, A., Grant, D., Salminen, J., Boddington, M., Thorpe, B., Wile, I., Toft, P. and Armstrong, V., *Chemosphere*, 19(1989), 637.
4. Kim, Y., See, S. Y. and Kim, M., *20th International Symposium on Halogenated Environmental Organic Pollutants and POPs*, 46(2000), 483.
5. Schechter A. Ryan J. J., *Chemosphere*, 17(1988), 915.
6. Djien Lien A. K., *Organohalogen Compounds*, 44(1999),1.
7. Schechter A., Dekin A., Weerasinge A. and Monson S, *Chemosphere*, 20(1990), 982.
8. Papke O., Ball M., Lis Z. A., Scheunert K., *Chemosphere*, 19(1989), 941.
9. Kim, J K., ph.D Thesis, " Study on the Distribution of PCDDs/PCDFs in Aquatic Organisms", 1996.