ANALYSIS OF POLYCHLORODIBENZO-P-DIOXINS AND DIBENZOFURANS(PCDD/PCDFS) IN BAKED SALTS AND BAMBOO-SALTS

Ki Cheol Kim[1], Kwang Sik Park[1], Su Kyeung Moon[1], Po Hyun Park[1], Jeung Bok Lee[1], Hoan Uck Ko[1], Jun Rae Yim[1] and Yoon Chang Park[2]

[1]Kyonggi-do Institute of Health & Environment, 324-1 Pajang-dong, Jangan-gu, Suwon, Kyonggi-do, 440-290, Korea
[2]Analytical Chemistry, Sungkyunkwan University, 300 chunchun-dong, Jangan-gu, Suwon, Kyonggi-do, 440-290, Korea

Introduction

The salt is basic material of all foods in dietary life. Specially, Korean people have eaten the high salty foods since early times. Also, a part of Asia country such as Korea treat with salt at high temperature and the processed salt is generally used by food additive. This high temperature process involves that infinitesimal organic materials on natural salt react with sodium chloride(NaCl) and it is connoting possibility that poisonous compounds such as poly chlorodibenzo-*p*-dioxins and dibenzofurans (PCDD/Fs) are formed. Because of cronic and acute health effects of PCDD/Fs, even extremely low levels[1,2]), detection of these contaminants in foods is very important. The aim of this paper is to present and discuss the levels of PCDDs/PCDFs in bamboo-salts and investigate the distribution characteristic of PCDD/Fs by modified EPA method 1613.

Methods and Materials

Samples of processed salts purchased from a local supermarket in suwon, South Korea.

The sample were extracted and cleaned up using modified EPA method 1613. Figure 1 shows flowchart of extract and clean-up procedure. The purpose of extraction is to remove the bulk of the sample matrix and to transfer the fraction containing the analytes in a suitable solvent. The matrix of salt is very simple and easy to extract the analytes. First saltes were dissolved in 2N HCl solution and followed by liquid-liquid extraction with dichloromethane. After removing the water layer, all the combined extracts of dichloromethane were preconcentrated and then changed the solvent to n-hexane. Clean-up steps are usually required to remove the bulk of co-extractants, to separate organochlorine residues into groups and to concentrate the final extract to appropriate volumes of solvent, allowing the detection of the PCDD/Fs at the ultra-trace levels. After extraction, each extract was condensed by distillation using a rotary evaporator and the combined samples were cleaned with commercial silica column(11(i.d)´177(L)mm)[3] and carbon column(11(i.d) ´10(L)mm). The column is connected with solvent delivery system(HPLC pump) that is able to adjust the flow rate of organic solvent. All analysis was performed using an GC 8000series(Fisons Instruments, Italy) equipped with a CTC 200S autosampler and an Autospec Ultima Mass Spectrometer(Micromass, UK) that was operated in the voltage selected ion recording mode at resolutions greater than 10,000RP(10 % vally definition).

Results and Discussion

Table 1 shows the results of dioxin analyses of the baked salts. The total PCDF/total PCDD concentration ranged from 31.63pg/g to 201.94pg/g in six sample. And TEQ values ranged from

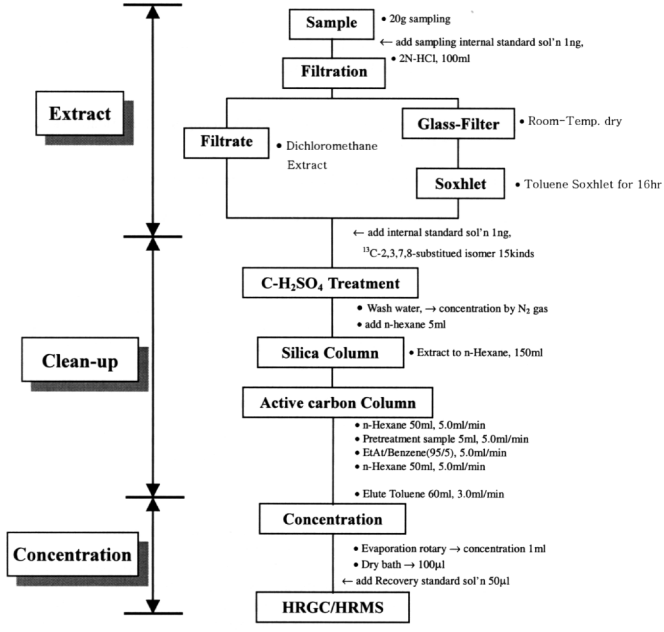

Figure 1. Flowchart of extract and clean-up procedure of salt samples

1.33pg TEQ/g to 16.92pg TEQ/g. These results show considerably higher than natural salt. It shows that PCDD/PCDFs are generated from high-temperature process of natural salt. Figure 2 shows characteristic profile of PCDD/PCDFs homologue in salt samples.

Table 2 shows the results of dioxin analyses of the bamboo-salts. The total PCDF/total PCDD concentration ranged from 12.47pg/g to 403.55pg/g in six sample. And TEQ values ranged from 0.71pg TEQ/g to 23.510pg TEQ/g. These results show considerably higher than natural salt. It shows that PCDD/PCDFs are generated from high-temperature process of natural salt. Figure 3 shows characteristic profile of PCDD/PCDFs homologue in bamoo-salt samples.

Table 1. The results of dioxin analyses of the baked salts

No. of Sample	PCDDs		PCDFs		Total Dioxins	
	pg/g	pg TEQ/g	pg/g	pg TEQ/g	pg/g	pg TEQ/g
BT	1.145	0.060	1.485	0.090	2.630	0.1550
A	25.221	0.880	6.450	0.450	31.67	1.330
B	5.132	0.590	8.940	0.950	14.070	1.540
C	10.696	1.370	11.77	1.110	22.463	2.480
D	28.420	1.950	15.04	1.410	43.460	3.360
E	21.925	3.220	56.41	6.110	78.335	9.330
F	41.228	2.840	160.712	14.080	201.940	16.920

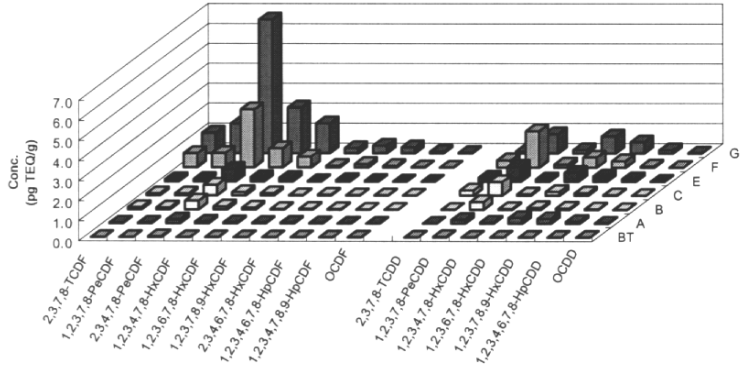

Figure 2. Homologue distribution of PCDD/Fs in baked salt samples.

Table 2. The results of dioxin analyses of the bamboo-salts

No. of Sample	PCDDs		PCDFs		Total Dioxins	
	pg/g	pg TEQ/g	pg/g	pg TEQ/g	pg/g	pgTEQ/g
BT	1.145	0.060	1.485	0.090	2.630	0.150
a	3.501	0.170	8.97	0.54	12.470	0.710
b	8.216	0.55	17.450	1.28	25.670	1.830
c	7.294	0.53	24.140	1.67	31.430	2.200
d	21.841	1.360	87.000	6.500	108.84	7.860
e	35.557	2.390	98.500	7.680	134.056	10.070
f	154.188	11.570	249.360	11.940	403.550	23.510

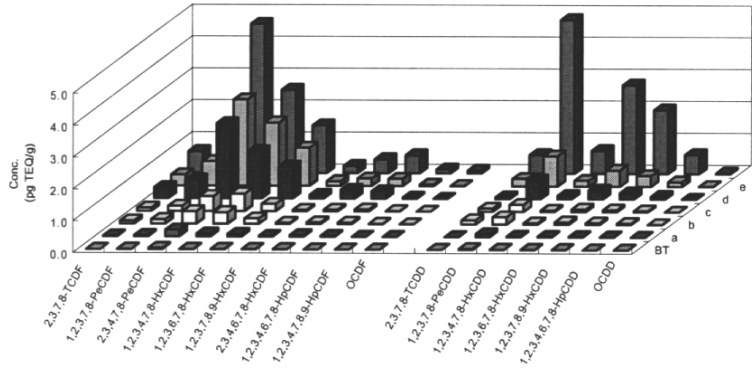

Figure 3. Homologue distribution of PCDD/Fs in bamboo-salt samples.

On the whole, the graph pattern of Fig.2 and Fig.3 is similar. But the total dioxins(TEQ) of bamboo-salt samples are higher concentrations than baked salts

This study provides an opportunity to look into homologue distribution of PCDD/Fs following dioxin-included baked and bamboo-salts in korea. However, further investigations are necessary to elucidate mechanism of PCDD/Fs in baked and bamboo-salts.

Ackowledgements

We are thankful to Dong Ki Kim(Kyonggi-do Institute of Health & Environment) for providing the analytical advice of HRGC/HRMS.

Reference

1. M.P. Esposito, T.O. Tieman, F.E. Dryden, *Dioxin*: U.S. EPA Report, EPA-600/2-80-197: U.S. GPO: Washington, DC, Nov (1980).
2. M.A. Kamrin, P.W. Rodgers, Eds, *Dioxins in the Environment*: Hemisphere Publisger Co., New York(1985).
3. Japan Ministry of Health and Welfare, Standard method for determination of dioxins in waste management, JMHW Notification No. 234(1997).