PCDD, PCDF, PCB CONCENTRATIONS OF MEAT IN KOREA

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Introduction

Polychlorinated dibenzo-p-dioxins(PCDDs) and dibenzofurans(PCDFs) are the most concerned toxic organic chemicals to human[1]. Because of their extremely high toxicity and uncertain genotoxic potential, their determination in environmental and biological samples are the subject of intense research[2,3]. In addition, WHO has included 12 co-planar PCBs which have similar toxicity as dioxins in the list according to the reassessement. Because dioxins have highly lipophilic property and slow elimination kinetics, these chemicals have strong tendencies to bioaccumulate in lipid-rich compartments of organisms, and the general public is exposed to dioxins mainly through contaminated food. Thus, the investigation of dioxins in food is very important[4]. In order to measure the levels of dioxins and to determine the major congener in meat, the concentrations of PCDDs, PCDFs and non-ortho co-planar PCBs have been analyzed by high resolution gas chromatography/high resolution mass spectrometry(HRGC/HRMS) in beef, pork and chicken.

Method and Material

Nineteen commercially available meat samples(beef, pork and chicken) were purchased from a local market in Seoul, Chuncheon, Daejeon, Kwangju and Busan in Korea. All the samples were minced and were kept at -20℃ until analyzed. The window defining and isomer specificity mixture(WD:EDF-4006), calibration standard(CS:EDF-4143), labelled compound spiking standard(LSC:EDF-4144), precision & recovery standard(PAR:EDF-7999) and internal standard(ISD:EDF-4145) were obtained from Cambridge Isotope Laboratory(Andover, MA, USA). The extraction thimble for Soxhlet extraction was Cellulose type(43 x 123mm, Whatman 2800432). Approximately 20g of sample was placed into an extraction thimble, added 80g of sodium sulfate anhydrous, mixed up, fortified with LCS, and then extracted for 18 hours using dichloromethane: hexane(3:1) in a Soxhlet extractor. After extraction, the lipid content in the sample was determined as published previously[5]. The residue was dissolved in 3ml of hexane, and loaded onto the top of a separate funnel packed with acidified Silica gel, and then stood for 20 minutes. The absorbed compound was eluted with 150ml of hexane and the hexane fraction was concentrated to about 12ml under the reduced pressure. The crude mixture was loaded onto the Silica gel column, passed through the alumina column, purified with 2% dichloromethane in hexane and then eluted with 50% dichloromethane in hexane. The eluant was loaded onto the carbon column to be purified again using 50% ethyl acetate in benzene. And then it was eluted with toluene. The clean-up work was done by the automatic Dioxin Prep System(FMS, Watham,

MA, USA). After evaporation, ISD was spiked and the final volume was adjusted to 10$\mu\ell$ with nonane. All analyses were performed on a HRGC/HRMS using the isotopic dilution method. Chromatographic separation were achived using a Hewlett Packard 6890 gas chromatograph with a 30m x 0.25mm(0.1μm film thickness) DB-5MS capillary column. The HRMS was operated in the electron impact ionization mode using multiple ion detection.

Results and Discussion

The recoveries were ranged from 80% to 153%. As presented in Table 1 the level of PCDD/Fs for beef, pork and chicken were 0.132, 0.042 and 0.021pgTEQ/g wet weight, respectively. In addition, the levels of non-ortho co-planar PCBs for beef, pork and chicken were 0.031, 0.006 and 0.072pgTEQ/g wet weight, respectively.

Concerning congener pattern, Co-PCBs are prominent congener in meat samples as shown in Figure 1. Concerning TEQ pattern, PCDFs contribution is greater than that of PCDDs in pork samples. PCBs contribution is greater than that of PCDD/Fs in chicken samples. And there was no particular trend in beef samples as shown in Figure 2.

References

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Table 1. PCDD, PCDF, PCB concentrations of meat samples

(pgTEQ/g ww)

Sample	PCDD/Fs	Co-PCBs	PCDD/F/Co-PCBs
Beef	0.132 (0.002~0.280)	0.031 (0.001~0.134)	0.164 (0.002~0.344)
Pork	0.042 (0.002~0.148)	0.006 (0.001~0.019)	0.048 (0.011~0.150)
Chicken	0.021 (0.005~0.032)	0.072 (0.015~0.266)	0.093 (0.020~0.298)

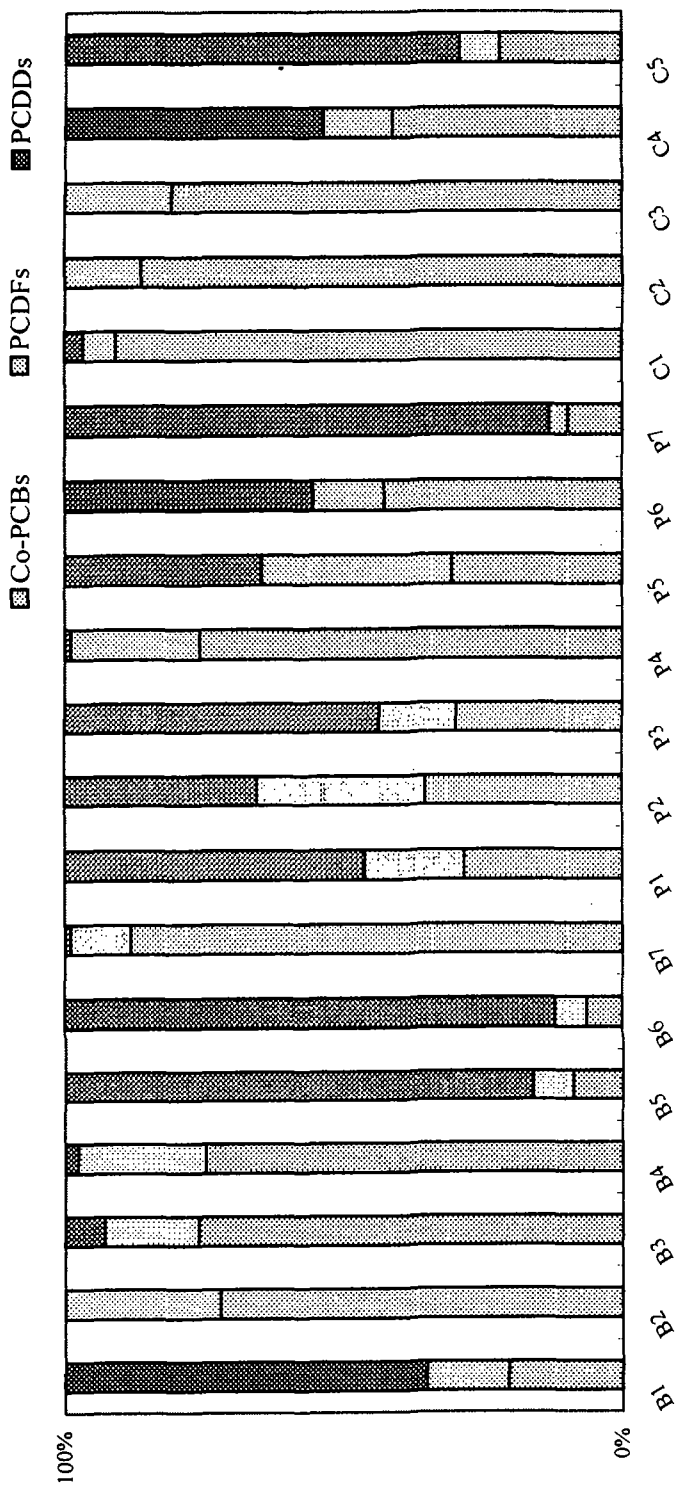

Fig. 1. The histogram of dioxin levels in meat (pg/g ww)
B: Beef P: Pork C: Chicken

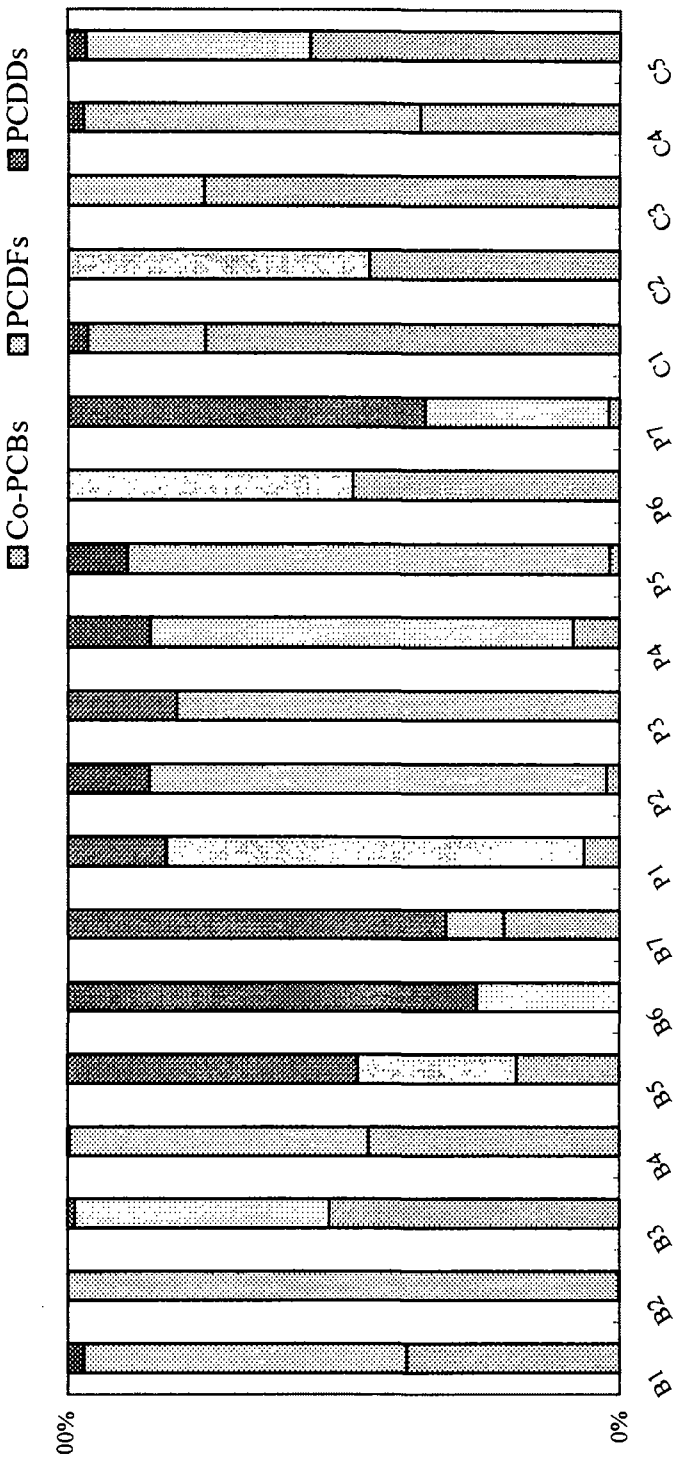

Fig. 2. The histogram of dioxin leves in meat (pgTEQ/g ww)
B: Beef P: Pork C: Chicken