TIME TREND OF PCDD/FS AND CO-PCBS CONCENTRATION AND COMPOSITIONS IN RICE LEAVES

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Introduction

It is well known that polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/Fs) and co-planer polychlorinated biphenyls (Co-PCBs) are lipophilic environmental contaminants. Food has been generally recognized as main source of human intake of these compounds. Among the foodstuffs rice consumption is high in Asian peoples. Tsutsumi *et.al.*[1] analyzed total diet samples of 14 food groups from 16 locations in Japan obtained in 1999 and 2000. They estimated that daily intake of PCDD/Fs from rice and rice products were about 1.8 % of the total intake. However, meat and eggs, milk and dairy products contributed 18.6 % and 7.4 %, respectively.

We reported PCDD/Fs in the above-ground portions of rice plant, such as leaf, stem, husk and rough rice. Concentrations of PCDD/Fs in stem and rough rice were very low. However, the highest concentration of PCDD/Fs was detected in leaf[2]. Some rice products with leaves were used as animal feed for farm animals, which can be an exposure route for dioxins.

Furthermore, some pesticides, such as 2,4,6-Trichlorophenyl 4-nitrophenylether (CNP) and Pentachlorophenol (PCP), had been used at paddy fields as herbicides. PCDD/Fs congeners, such as 1,3,6,8-TeCDD, 1,3,7,9-TeCDD and OCDD are found as impurities of these herbicides[3]. These congeners are widely distributed in aquatic environment in Japan[4].

Therefore, it is important to investigate PCDD/Fs and Co-PCBs in whole crop of rice, especially in leaves, for food safety. In this study, rice leaves were collected and analyzed from rice planting to the harvest time. Then concentration and composition of PCDD/Fs and Co-PCBs were evaluated.

Materials and Methods

Rice leaves were collected from June 5, 2001 to September 28, 2001. All the samples were Soxhlet extracted with toluene. Purification and separation were carried out by multiplayer silica gel, alumina and activated carbon column chromatography. Samples were analyzed by HRGC/HRMS (HP6890/ Auto Spec-Ultima) equipped with a SP-2331 (SPELCO) and DB-5ms (J&W SCIENTIFIC).

Results and Discussion

Concentrations of PCDD/Fs and Co-PCBs in rice leaves were ranged from 88 to 500 pg/g wet weight (mean: 190 pg/g wet weight), and from 30 to 80 pg/g wet weight (mean: 47 pg/g wet weight, respectively. Concentration of PCDD/Fs was higher than that of Co-PCBs. TEQ were ranged from 0.29 to 3.3 pg/g wet weight (mean: 0.81 pg/g wet weight).

Fig. 1 shows that time trend of PCDD/Fs and Co-PCBs concentrations and TEQ in rice leaves. The highest concentration was detected just after rice planting (June 12), then, reduced drastically in summer. After summer, concentration was increased gradually. Fig. 2 shows PeCDDs and TeCDFs congener patterns in paddy soil, air and rice leaves (June 12, July 17 and September 20). The patterns

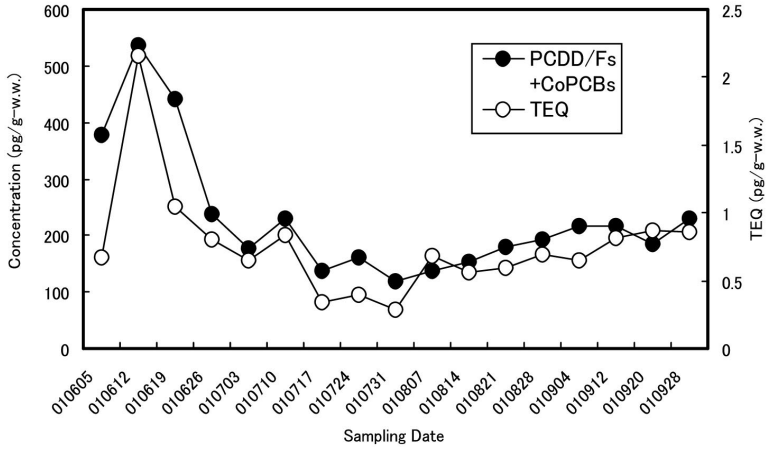

Figure 1. Time trend of PCDD/F, Co-PCB concentracions and TEQ in rice leave

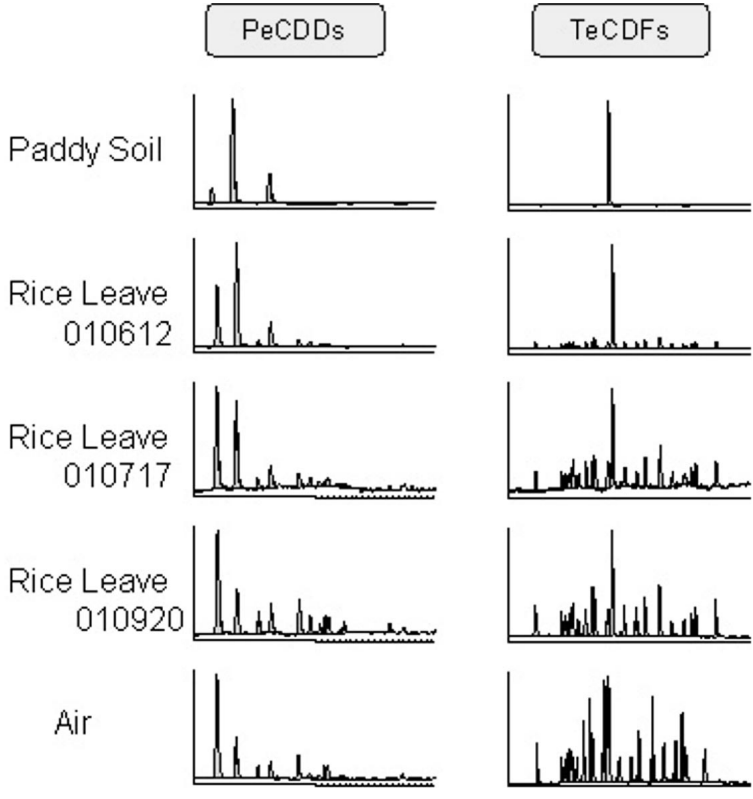

Figure 2. PeCDDs and TeCDFs congener patterns in paddy soil, air and rice leaves

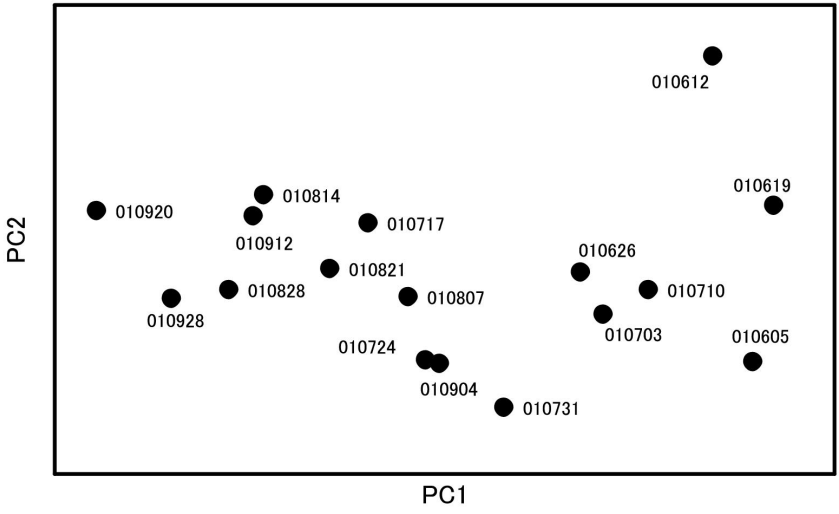

Figure 3. Principal component analysis plot on rice leavel

in rice leaves on June 12 were resembled with paddy soil. On September 20, pattern in rice leaves was identical with Air. Therefore, it can be indicated that composition of PCDD/Fs in rice leaves were changed daily.

Principal component analysis (PCA) was used to examine similarities and differences in the multivariate mixtures of PCDD/Fs in the samples. All the congener concentrations were normalized to total PCDD/Fs and Co-PCBs. Two PCs explained 92 % of data variation (Fig. 3) and it was supported with the results on Fig.2.

In the summery, it can be explained that PCDD/Fs and Co-PCBs in rice leaves were originated from adsorption of paddy soil particles just after rice planting and highest concentration was detected. Then, rapid decreasing of these compounds could be suggested due to increasing of plant mass by growth, washout of particles on leaves and photodegradation[5]. Daily variation of PCDD/Fs source was also expected from paddy soil particle and atmospheric deposition.

References

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