PCDD/F CONCENTRATIONS IN SHELLFISH COLLECTED FROM THE COASTAL AREAS OF BOHAI SEA, CHINA AND THEIR ESTIMATED LEVELS IN THE SEA WATER

Yang N[1], Matsuda M[2], Kawano M[2], Wakimoto T[2]

[1] Hiyoshi Corporation, Omihachiman 523-8555 Japan; [2]Faculty of Agriculture, Ehime University, Matsuyama 790-8566 Japan

Abstract

PCDD/Fs in shellfish collected from local supermarkets located along the Bohai Sea, China were measured. Average TEQ values of PCDD/Fs determined in the shellfish which from Dalian, Qingdao, Yantai and Tianjin were 0.102, 0.042, 0.049 and 0.040 pg-TEQ/g wet weight, respectively. These TEQ values were slightly lower than the shellfish from the coastal areas of Japan. Moreover, PCDD/Fs in shellfish and seawater which were collected from coastal areas of Ehime, Japan were analyzed in order to elucidate a correlation between the levels in shellfish and seawater. The results indicated that a good correlation was found between the both. Consequently, concentrations of PCDD/Fs in seawater of Bohai Sea were estimated by the correlation obtained with the Japanese samples. The estimated levels of PCDD/Fs in seawater of Bohai sea, China were similar to those detected in seawater of coastal areas of Ehime, Japan. Further investigation is required to understand an environmental behavior of PCDD/Fs in Bohai Sea marine ecosystems.

Introduction

The coastal area of Bohai Sea is regarded as a remarkable economic developing area in China. It is also an important place of industrial activities. However, environmental pollution is a major concern because of the over population and also the rapid industrialization. Particularly, the data about PCDD/Fs contamination status of the coastal area of Bohai sea, China are limited.

As receiving the effluent from factories and domestic discharges, seawater in the coastal area might be polluted with some chemicals such as PCDD/Fs. Once the PCDD/Fs are released in the seawater it might be taken to phytoplankton and fish. Furthermore, through the food chain, it might be accumulated, and caused adverse effect on the wildlife and human beings. Hence it is necessary to monitor the level of PCDD/Fs in seawater of Bohai Sea in order to understand the levels and to assess the effects done to the environment. Although various species of organisms can be potentially used as bio-monitoring organisms, shellfish is a suitable organism due to a measurable accumulation response for persistent organic pollutants (POPs) such as PCDD/Fs and easy to collect.

This study presents the PCDD/F concentrations in the shellfish collected from the coastal area of Bohai sea

and try to estimate the concentrations of PCDD/F in seawater based on those of shellfish as a biomarker.

Materials and Methods

Shellfish samples were purchased during 18th to 25th of August 2004 from supermarkets in Dalian, Zhuanghe, Qingdao, Yantai and Tianjin located along the Bohai Sea, northeastern part of China. Before buying,, it was confirmed that the shellfish samples were collected in the coastal areas of the concerned cities. In addition, seawater (about 40L) and shellfish samples were collected from the coastal areas of Ehime, Japan, in detail coasts of Matsuyama, Masakicho, Imabari, Saijotoyo and Shikokuchuo, from September to October, 2005. These seawater samples were analyzed by using the procedures previously reported by Matsuda et al.[1)]. Shellfish samples were analyzed by using the analytical guidelines of dioxins for aquatic organisms presented by the Ministry of the Environment, Japan. The procedure was briefly reported by Seike et al.

Results and Discussion

TEQ values [average (minimum – maximum)] of PCDD/Fs in shellfish from Dalian, Qingdao, Yantai and Tianjin were 0.102 (0.011-0.287), 0.042 (0.033-0.061), 0.049 (0.023-0.075) and 0.040 (0.014-0.082) pg-TEQ/g wet weight, respectively (Table 1). These TEQ values were similar or lower than the values, 0.223 (0.111-1.97) pg-TEQ/g wet weight [3)] which were detected in the shellfish from the Japanese coast.

It is thought that shellfish is a suitable bio-indicator organisms because of a measurable accumulation response for POPs such as PCDD/Fs and easy to collect. Mussel has been actually used widely as bio-indicator organisms for POPs monitoring. Results based on the analytical data related the shellfish and seawater samples from Ehime, Japan, it was suggested that the relative abundance of individual PCDD/F congeners in shellfish were reflected those of seawater samples. Moreover, a high correlation was found between PCDD/F concentrations of the seawater and the concentration in shellfish The formular is as follows: $Y = 1.29X$ $R^2 = 0.95$, where, Y: concentrations pg/L in seawater, X: concentrations pg/g wet wt in shellfish). This result suggests that we could predict the PCDD/F concentrations in seawater from the PCDD/Fs concentration in the shellfish. It was estimated that the concentration in seawater from the PCDD/Fs concentrations of the shellfish, which was obtained in the coastal area of Bohai Sea in China, and with this result the PCDD/Fs concetration of coastal waters of Dalian, Qingdao, Yantai and Tianjin was each 13.2, 7.74, 5.79 and 4.00pg/L. These concentration levels are similar to that detected in seawater of the coastal areas of Ehime, Japan (Fig.1). This has also been clearly understood by Whitney U-test.

Table 1 Concentrations of PCD/Fs (pg/g wet wt.) and TEQ values (pg-TEQ/g wet wt.) in shellfish from Coastal Area of Bohai Sea, China

Location	Dalian					Qingdao			Yantai		Tianjin		
Sample	Blue mussel	Purple washington clam	Conch clam	Oyster	Clam	Bladder moon shell	Oyster	Clam	Bladder moon shell	Clam	Blue mussel	Bladder moon shell	Clam
PCDDs	1.77	0.444	1.58	5.84	0.507	1.95	1.03	0.710	2.89	0.620	0.880	1.25	0.348
PCDFs	6.32	1.98	8.35	22.4	1.67	4.44	4.64	5.24	4.13	1.33	3.10	2.85	0.865
PCD/Fs	8.09	2.43	9.92	28.3	2.17	6.39	5.67	5.95	7.03	1.95	3.98	4.10	1.21
TEQ-PCDDs	0.016	0.003	0.035	0.091	0.008	0.017	0.012	0.007	0.030	0.001	0.009	0.027	nd
TEQ-PCDFs	0.042	0.008	0.085	0.196	0.026	0.044	0.021	0.026	0.045	0.021	0.014	0.055	0.014
TEQ	0.058	0.011	0.120	0.287	0.033	0.061	0.033	0.033	0.075	0.023	0.023	0.082	0.014

nd: not detected

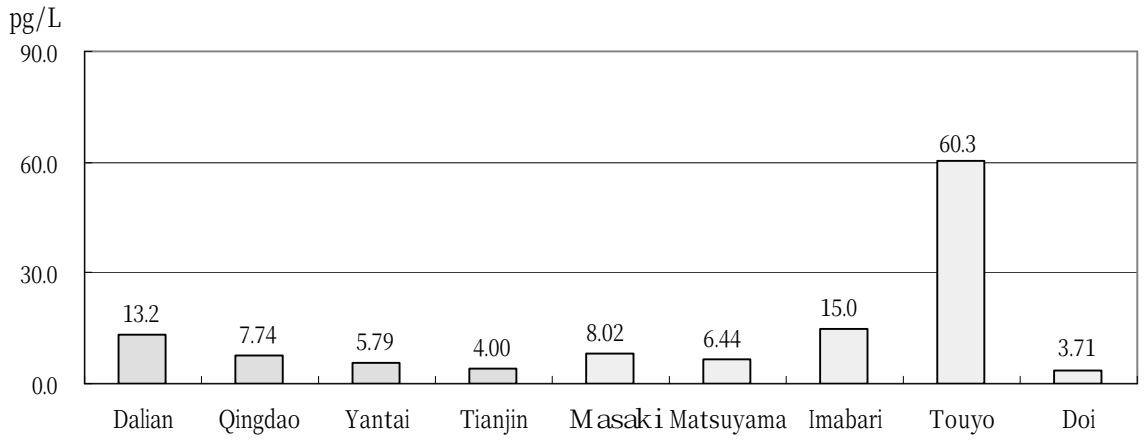

Fig. 1 Comparison of concentrations of PCDD/Fs estimated in sea water from Coastal Area of Bohai, China with those detected from coastal areas of Ehime, Japan

References

1) Matsuda M, Horii Y, Seike N, Wakimoto T. Organohalogen Comp 1997; 33: 41.

2) Environmental Agency, Japan, Analytical procedures for aquatic organisms, 1998.

3) Fisheries Agency, Japan, Reports of Dioxins monitoring for shellfish (1999 – 2002), (2003).

4) Yang N, Matsuda M, Kawano M, Wakimoto T. Proceedings of annual meeting on environmental chemisty, 2005; 15: 835.