CONTROL INSTRUMENTATION OF PCDD/FS CONTENT IN FOODSTUFF IN RUSSIA

Zarema Amirova, Edward Kruglov, Irina Donnic[1], Elena Grosheva[2]

Environmental Research&Protection Centre, 147, October Avenue, 450075, Ufa, Russia
[1]Ural State Agricultural Academy, 42, Libknecht Street, 620219, Ekaterinburg, Russia
[2]Institute of Ecological Toxicology, 665932, P.O. Box 78, Baikalsk, Irkutsk Region, Russia

Introduction

Monitoring of PCDD/Fs content in fat-containing foodstuff has not been carried out on national basis in Russia though health standards of permissible PCDD/Fs concentration have been set by the Regulations of the Chief sanitary inspector of the Russian Federation. The standards are as follows: in milk and diary 5.2 ng/kg of fat; in fish and fish products: in eatable part – 11.0 ng/kg, converting into fat – 88.0 ng/kg; in meat and meat products: in eatable part – 0.9 ng/kg, converting into fat – 3.3 ng/kg. The allowable PCDD/Fs intake admitted in Russia is 10 pg/kg of body burden.

In the absence of industrial emission sources PCDD/Fs primarily get into human organism via foodstuff. The degree of toxicity load on people due to PCDD/Fs in foodstuff has been determined in the Republic of Bashkortostan [1] and in Irkutsk region [2]. Data on other regions of Russia are occasional [3] but they don't point to the problems of the main fat-containing products' pollution.

By the present time new data were obtained at the Environmental Research&Protection Centre, Ufa, Russia

- in the course of inventorying dioxin sources in Russia – PCDD/Fs content in butter from different regions (grant of the USEPA X827697-01-0);
- as a result of research carried out by the Ural Agricultural Academy in Ekaterinburg in 2000;
- as a result of analysing meat and diary produce in Irkutsk region;
- as a result of test checks of polluting marketable products by some enterprises in Russia.

Besides, taking into consideration a possibility of importing to Russia some meat and poultry with high PCDD/Fs content control testing of large lots of meat and poultry coming to the Republic of Bashkortostan, from Belgium, France, Denmark, Holland and USA was carried out in 1999.
The present report summarises the results of these studies.

Materials and Methods

Foodstuff was sampled in different regions of Russia and was stored at -20^{0}C up to the moment of analysing. A sample (20g of meat/liver, 10g of sausage, 5g of butter, 100g of cow milk) after adding surrogate compounds, homogenising and drying with Na_2SO_4 was extracted by a mixture of solvents (CH_2Cl_2/C_6H_{14} = 2.5/3.5). Lipids were determined and then decomposed. The extracts were purified by column chromatography with the use of SiO_2, Al_2O_3 and Carbopac-C/Celite 545. PCDD/Fs quantitative analysis was performed by the method of HRGC/HRMS in compliance with 1613B US EPA methods with the use of capillary column DB-5 MS (60m) and a high-resolution mass spectrometer Autospec-Ultima, Micromass (10000).

For toxicological assessment of polluting the samples with PCDD/Fs the scale WHO-TEQ was used. Duplicate and blank experiments on model matrixes were performed for all samples. The degree of recovery made 43-116%, MDL made from 0.4 ppt (TCDD) to 0.9 ppt (OCDD).

Table 1 The sampling from regions of Russia and imported foodstuff from EU and USA

Produced in	Number of samples	Sample
Primorsky Territory, Russia	1	Butter
Kurgan Region, Russia	1	Butter
The Republic of Adygea, Russia	1	Butter
Bashkiria, Russia	6	Butter
Sverdlovsk Region, Russia	3	Butter
Irkutsk Region, Russia	2	Butter
Sverdlovsk Region, Russia	4	Cow milk
Bashkiria, Russia	26	Cow milk
The Republic of Komi	2	Cow milk
Bashkiria, Russia	17	Beef
Bashkiria, Russia	14	Pork
Sverdlovsk Region, Russia	3	Cow liver
Sverdlovsk Region, Russia	4	Beef
Irkutsk Region, Russia	4	Beef
Irkutsk Region, Russia	2	Pork
Samara Region, Russia	3	Cow milk
Bashkiria, Russia	7	Chicken
Sverdlovsk Region, Russia	2	Chicken
Bashkiria, Russia	12	Sausage
Nizhegorodskaya Region, Russia	4	Sausage
Moscow, Russia	7	Sausage
USA*	5	Turkey
Denmark*	2	Pork
Belgium*	4	Chicken
France*	2	Chicken
France*	2	Turkey

* - samples of food bought in Ufa

Results and Discussion

The results of PCDD/PCDFs determination are given in Tables 2 and 3.

Table 2. PCDD/Fs in the samples of products imported from European countries and USA (market of Ufa, Russia), WHO-TEQ, pg/g lipids

Object	Region	PCDD/Fs	Object	Region	PCDD/Fs
Butter	Holland	0.89±0.21	**Poetry**	France	1.46 ±0.32
Meat	France	2.03	**Poetry**	Belgium	1.1±0.43
Meat	Denmark	0.96±0.04	**Poetry**	USA	1.48 ±0.97

Table 3. PCDD/Fs in the samples from Russian regions, WHO-TEQ, pg/g lipids

Object	Region	PCDD/Fs	Object	Region	PCDD/Fs
Butter	Bashkiria	0.47±0.12	**Meat**	Bashkiria	1.63±0.05
	Sverdlovsk region	1.37±0.04		Sverdlovsk region	4.38±0.22
	Irkutsk region	1.11		Irkutsk region	1.12±0.07
	Kurgan region	0.60	**Milk**	Komi republic	1.38±0.3
	Primorsky Territory	1.02		Bashkiria	2.22±0.21
	Adygea	1.13		Sverdlovsk region	1.61±0.55
Liver	Sverdlovsk region	4.29±0.16		Samara region	2.34±0.04
Poetry	Bashkiria	1.33±0.30	**Sausage**	Bashkiria	1.43±0.78
	Sverdlovsk region	2.37		Moscow	2.19±1,12
				Samara region	0.78±0.12

As a rule the content of PCDD/PCDF high-chlorinated isomers in samples from Russia is lower than in samples from other regions of the world (Table 4).

Table 4 Content of isomer groups in samples of different origin (poeltry fat, pg/g lipids)

PCDD/Fs	Russia	USA	PCDD/Fs	Russia	USA
TCDD	0,23	0,21	TCDF	0,25	3,57
PnCDD	0,15	0,38	Σ PnCDF	2.28	0,52
Σ HxCDD	1.09	1.87	Σ HxCDF	2.31	3.41
Σ HpCDD	1.63	3.70	Σ HpCDF	1.63	2.89
OCDD	2,63	9,57	OCDF	1,07	2,33

Mean values of individual PCDD/Fs isomer concentrations in different kinds of foodstuff produced in Russia are given in Table 5.

Table 5. Mean values of PCDD/Fs content in samples of foodstuff produced in Russia

PCDD/Fs	Milk	Butter	Liver	Sausage	Poultry
2378-TCDD	1.9±0.29	0.14±0.1	0.81± 0.47	0.18 ±0.10	0.18± 0.13
12378-PnCDD	0.51± 0.41	0.06±0.05	1.78± 1.60	0.26 ±0.24	0.38± 0,25
123478-HxCDD	0.55± 0.76	0.11±0.10	0.85± 1.05	0.26 ±0.20	0.28± 0,14
123678-HxCDD	0.96± 0.82	0.25±0.24	1.84± 0.93	0.29 ±0.22	0.45± 0,17
123789-HxCDD	0.97± 1.12	0.15±0.15	2.58± 4.25	0.24± 0.23	0.19± 0,07
1234678-HpCDD	2.89± 1.57	0.98±0.75	6.82± 3.15	0.85± 0.51	1.11± 0,67
OCDD	8.13± 4.58	2.79±2.06	18.5± 3.59	2.87± 1.19	3.2± 2.08
2378-TCDF	0.71± 0.49	0.55±0.29	3.62± 1.73	1.69± 1.02	1.7± 0.42
12378-PnCDF	0.96± 0.83	0.25±0.10	1.5± 0.31	0.73± 0.38	0.71± 0.19
23478-PnCDF	1.25± 0.70	0.87±0.36	2.41± 0.54	1.54± 1.19	1.15± 0.36
123478-HxCDF	2.40± 2.51	0.66±0.45	3.2± 1.90	1.12± 1.02	0.76± 0.25
123678-HxCDF	1.17± 0.94	0.28±0.15	1.7± 1.13	0.65± 0.68	0.40± 0.21
123789-HxCDF	1.07± 1.53	0.2±0.07	1.11± 0.26	0.3 ±0.22	0.20± 0.07
2346678-HxCDF	0.96± 0.80	0.27±0.1	2.16± 1.73	0.59± 0.49	0.42± 0.20
1234678-HpCDF	3.1 ±1.36	0.92±0.82	5.65± 1.23	2.74± 4.19	0.98± 0.60
1234789-HpCDF	1.11± 1.79	0.20±0.04	0.95± 0.3	0.39± 0.58	0.20± 0.08
OCDF	5.74± 3.23	1.31±1.68	11.1± 2.73	1.8± 3.24	1.07± 0.30
WHO-TEQ	**2.44 ±1.62**	0.91±0.36	**4.76± 1.52**	**1.68±1.06**	**1.42± 0.44**

ND = ½ MDL

Of course these data may be used as a preliminary characteristic of foodstuff pollution in Russia taking into account vast territories and different levels of load on them.

However as far as in the examined regions there is no considerable excess over the Russian standards and comparison with the published data on Europe and North America is more often in favour of Russian products it is obvious that the level of PCDD/Fs pollution in Russia on the whole is lower and the risk of human exposure through the food chain in Russia is within admissible limits of content.

References

1. Maistrenco V., Amirova Z., Kruglov E., Chamitov R. Chemosphere, 1998, 37, 9-12, p.1699.
2. Mamontova E., Mamontov A., Tarasova E. Organohal. Comp., 2000, 48, p. 260.
3. Schecter A., Furst P., Gloebel W., Constable J., Kolesnikov S., Beim A., Boldonov E., Vlasov B., Hoang T., Chemoshere, 1990, 7-9, p. 799.