CONTENT OF PCBs IN FOOD OF ANIMAL AND PLANT ORIGIN IN VOJVODINA (SERBIA) AFTER INDUSTRIAL DISASTERS IN 1999

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ABSTRACT

Food is the main source of the contamination of humans by polychlorinated biphenyls. In this paper the content of PCBs in various types of food of plant and animal origin was determined. Foodstuffs were collected during season 2002 and the content of PCBs was determined by gas chromatography. The results indicate low residual level of these hazardous substances in Vojvodina.

INTRODUCTION

During NATO intervention in 1999 almost daily attacks on major industrial sources have caused numerous industrial accidents in Serbia. The most severely attacked cities were Pancevo, Novi Sad and Kragujevac. Various storage and production tanks containing toxic chemicals were damaged or destroyed. These accidents resulted in release of many hazardous chemical substances including polychlorinated biphenyls (PCBs). As a consequence, chemicals either leaked into the ground or were burnt in the resulting fire, causing widespread soil and air pollution. In the second stage, released pollutants bioaccumulated in plants and biomagnified in animals in the vicinity of the destroyed targets, making them a significant source of PCB dietary exposure of humans.

EXPERIMENTAL

Sampling

Samples of grain crops, vegetables and fruits were collected from the agricultural complexes near Novi Sad, Vojvodina, over a period of two years (2001-2002). Samples of meat, milk and eggs were obtained in 2002 from cattle, pig and poultry farms, each comprising sample taken from 50 animals. Samples of fish were collected from different part of the Danube, as well as from fish farm in the vicinity.

Extraction and purification

Grains. The sample (20-25 g) is ground and extracted in the Soxhlett apparatus with n-hexane for 6 hours. Hexane extract is evaporated and the residue is

dissolved in hexane so that 1 ml of the solvent contains 40-50 mg of fat. Organic matter is destructed by concentrated sulfuric acid and rinsed several times with distilled water.
Meat. 20-25 g of sample is mixed with the same amount of anhydrous sodium sulfate and quartz sand. The same procedure of extraction and purification is applied to the sample.
Milk and dairy products. 50 ml of milk is heated with a few drops of acetic acid and filtered. Precipitate is mixed with sodium sulfate. Dairy products are directly mixed with sodium sulfate, extracted and purified.
Eggs. Yolks of eggs are separated, measured and mixed with anhydrous sodium sulfate. The described procedure is followed. The recovery of this method is over 95%.
Fruits and vegetables. 50 g of the sample is blended with 100 ml of toluene and 50 ml of propanol-2 for 3 minutes. Liquid is transferred into separation funnel and shaken for 1 minute with 2% solution of sodium sulfate. Toluene layer is purified with concentrated sulfuric acid and rinsed with distilled water.

Gas chromatographic analysis

Instrument configuration: Instrument: HP 6890 GC; Detector: ECD; Column: capillary HP-5% Phenyl-Methyl-Siloxane; applied method: EPA 625

RESULTS AND DISCUSSION

Of six investigated PCB congeners, in food samples only three were detected: PCB 28, PCB 52 and PCB 138 (Table 1.).

Table 1. Percents of samples in which PCBs were detected

Pollutant	No. of samples in which the pollutant was detected *(total number of samples **n=45**)*	Percents of samples in which pollutant was detected (%)
PCB 28	8	**2,0**
PCB 52	4	**8,9**
PCB 101	0	0
PCB 138	7	**17,5**
PCB 153	0	0
PCB 180	0	0

PCB congeners were detected in only four types of foods. In grains, pork and fruits and vegetables congeners PCB 28 and PCB 138 were present, and in fish, besides PCB 28, very high content of PCB 52 was detected(Fig 1.). The content

of total PCBs is the highest in fish, which is in accordance with the transportation pathway of PCBs and their bioaccumulation in aquatic organisms.

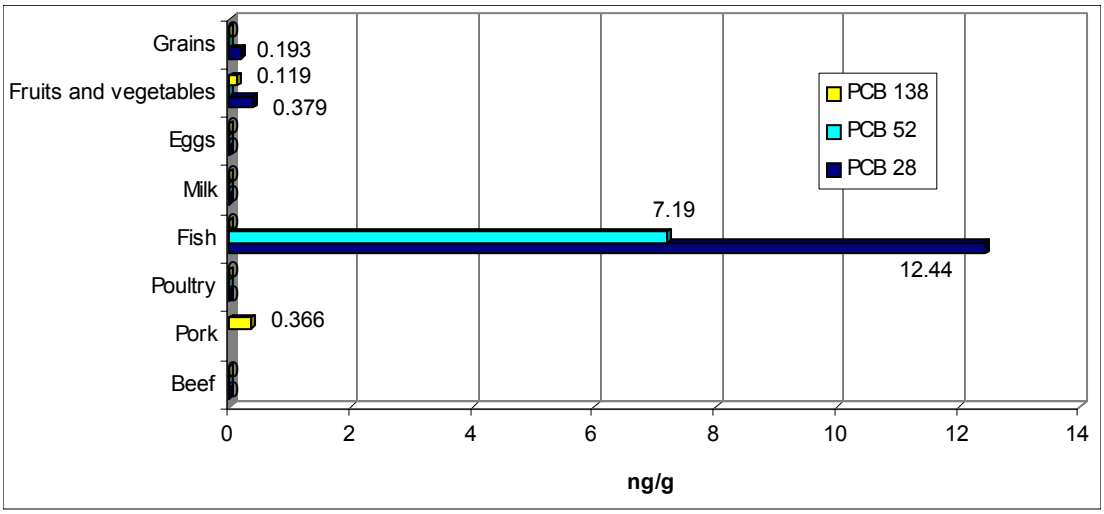

Fig. 1. Content of PCBs in the investigated foodstuffs

Content of PCBs in most of the investigated samples of food is similar or lower than in the other countries of the Mediterranean region for which there is published data, In all investigated samples the residual level of PCBs is lower tan the maximally allowed values proposed by FDA (*Food and Drug Administration).*

Table 3. Content of total PCBs in foodstuffs in some countries of the Mediterranean region

	Poultry	Eggs	Cow's milk	Fruits and vegetables	Fish
Serbia (2002)	0	0	0	0.50 ng/g	0.02 μg/g
Slovenia (1) (2000)	2-530 μg/g fat	0.6-85 μg/g	0.9-33.6 ng/g fat	0.01-25 ng/g	0.21-177 μg/g
Croatia (2) (2001)	-	-	5 ng/g fat	-	-
Spain (3) (1999)	0.20-0.34 μg/g fat	-	0.35-4.36 ng/g fat	-	-
France (4) (2000)	-	-	-	-	0.045-0.274 μg/g
Egypt (5) (1990)	-	-	1.83 ng/g fat	-	-
Tolerancies (FDA)	3.0 μg/g	0.3 μg/g	1.5 μg/g	No data	2.0 μg/g

CONCLUSION

In spite of the spills of Pyralene oils from the transformers in the Oil Refinery in Novi Sad in 1999, content of total PCBs was not significantly raised compared to the pre-war values. The reason for this may be the slow migration process of PCBs, and this fact calls for the systematic monitoring of the food quality in the future in order to determine the potential risk of PCB contamination in the exposed human population.

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