Dioxin Pollutions of Great Coal and Industrial Region

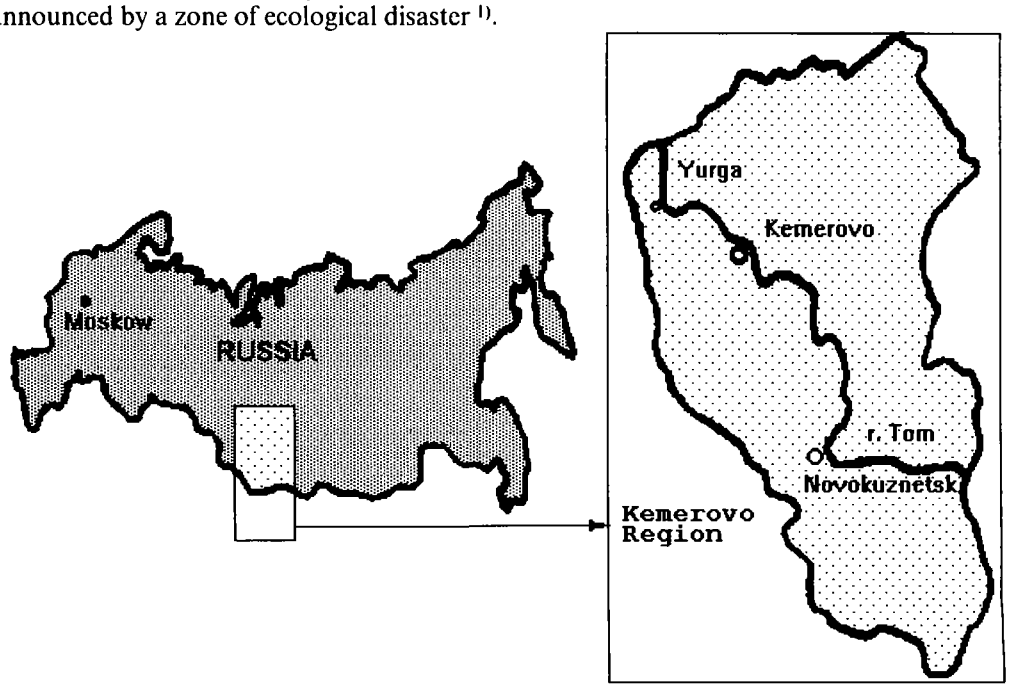
Nikolai V. Bodoev, Sergei I. Uskov, Valentin P. Naidanov and Vladimir I. Ovdenko, Institute of Coal SB RAS, Sovetsky Avenue 18, Kemerovo 650099, Russia

Abstract

Levels of the dioxins contents in objects of an environment, effluents of manufacture and products of feeding are for the first time determined in the industrial region of Russia - Kuzbass. The contents of the toxicants in a number of objects strongly exceeds level allowable in Russia. Concentration of the dioxins founded in human milk from Kemerovo are highest in Russia exceeding by those in cities Novosibirsk, Irkutsk and Ufa and comparable with a similar parameter in Sterlitamak.

Introduction

Kemerovo region located on the south of western Siberia is the most industrially advanced region in Russia and produces a coal, metals, chemical and other production. In connection with extremely hard an ecological situation in Kemerovo region, it is announced by a zone of ecological disaster [1].



Dioxin '97, Indianapolis, Indiana, USA

On a background numerous harmful pollution controllable on a territory of Kemerovo region account of dioxins pollution is necessary also, as far as besides destroying action on immunity of the person these substances strengthen action of other chemicals [2].

Prior to the beginning this research (1994) the analysis of samples of Kuzbass was not accomplished that made impossible to evaluate degree of pollution by dioxins of an environment, to reveal sources of their discharge and to develop measures on prevention of issue dioxins, as well as to determine a degree of contamination of the people these toxicants.

The purpose of the present work is to obtain of experimental data about the contents dioxins in various objects Kemerovo region.

Experimental methods

The standard spesimens of isotop labelled $^{13}C_{12}$ - 2,3,7.8 - TCDD, $^{13}C_{12}$ - 1,2,3,7,8 - PnCDD, $^{13}C_{12}$ - 1,2.3,6,7,8 - HxCDD, $^{13}C_{12}$ - 1,2,3,4,6,7,8 - HpCDD and $^{13}C_{12}$ - OCDD of the firm CIL (USA) were used in the work.

Extraction and preparation of samples for the analysis.

Water. A mix of labelled dioxins was added to sample of water and it extracted by means of methylene chloride.

Bottom sediments. 50 g homogenized sample of bottom sediments were mixed with 200 g waterless Na_2SO_4, isotop labelled standards were added and dioxins were extracted in glass column by 700 ml of a mix n-hexan-methylene chloride (1:1 v/v).

Milk. Dioxins extracted according to a technique [3].

Meat. The samples of meat were minced in meat grinder, internal standards were added and all mixed with double quantity Na_2SO_4 and placed in a glass column. Dioxins were extracted by n-hexan - methylene chloride (1:1 v/v). After shaking with silicagel extract was being washed by sulfuric acid up to complete discoloration.

Effluents. After homogenization and addition of the internal standards the samples were extracted by a mix n-hexan - methylene chloride (1:1 v/v). Extract were washed by sulfuric acid and then sodium hydroxide.

All extracts were cleared and prepared for the analysis on a technique [4].

Determination of PCDD and PCDF.

Chromatomass-spectrometer FINNIGAN MAT H-SQ-30, chromatograph VARIAN 3400 and system of data processing SS 300 were used. Separation conducted on quartz capillary column (30 m x 0,25 mm) with a stationary phase HP-5 (thickness of a film 0,52 mkm). The temperature varied from 160 ^{0} up to 220^0 C (25 deg/min), than up to 270^0 (5 deg/min). This temperature was being kept up to the end of eluation PCDD and PCDF. Pressure of a gas carrier (He) on an entrance was 0,56 kg/см^2, flow rate - 1,5 ml/min. Mass spectra were obtained in ionization by an electronic beam with energy 70 eV at emission current 1 mA. Accelerating voltage was 1 кV, resolution 6000. Analysis was made in the MIS mode by registering selective mass-chromatograms in a high resolution regime by ions with given exact mass.

Prepared sample was dissolved in 10 mkl n- tetradecane and 1 mkl of the solution, entered in chromatograph in the splitless mode.

Results and discussion

By choice of objects of prime research we proceeded from following reasons:

- The most probable dioxins content

The river Tom is a main source of a water in Kuzbass and accepts household and industrial wastewater of cities placed on it: Mezhdurechensk, Novokuznetsk, Kemerovo and Yurga. The emissions of factories settles and adsorbs on snow and this is a parameter of seazonal dioxins ejection.

- Presumed source of dioxins

We selected manufacture of p-chlorophenol and processes of reclamation of chlorocontaining organic products from numerous manufactures discharging dioxins.

- Gravity for life of the person

For research a drinking water of the largest cities of Kuzbass, meat and milk, made near to them, as well as breast milk of the women, living in the most polluted region of Kemerovo were chosen.

The results of dioxins determination are submitted in the table. Dioxins are found out in all without exception investigated objects. As one would expect the most great contents of dioxins in still residue of manufacture p-chlorophenol was revealed. These wastes were removed in non-equipped dump and even earlier were incenerating on opened air. Obviously, similar dumps are dangerous for an environment.

Table: Dioxins contents in objects of Kemerovo region

Objects	Total Dioxin Equivalents	Food	Total Dioxin Equivalents
Environment		Drinking water (Novokuznetsk)	5.62 pg/l
Water r. Tom (Novokuznetsk)	9.34 pg/l	Drinking water (Kemerovo)	7.67 pg/l
Water r. Tom (Kemerovo)	5.31 pg/l	Drinking water (Yurga)	1.14 pg/l
Bottom sediments r. Tom (Kemerovo)	5.68 ng/kg	Beef (Kemerovo)	0.18 ng/kg [1]
Water from snow (Novokuznetsk)	2267 pg/l	Meat of chicken (Kemerovo)	0.18 ng/kg [1]
Effluents			
Absorbing water ("Organica" Novokuznetsk)	45.89 pg/l	Cow milk (Kemerovo)	4.58 ng/kg [2]
Still rezidue of p-chlorophenol ("Spectr" Kemerovo)	647700 ng/kg (0.65 mg/kg)	Cow milk (Novokuznetsk)	1.20 ng/kg [2]
Effluent of salts ("Azot" Kemerovo)	0.18 ng/kg	Breast milk (Kemerovo)	56.12 ng/kg [2]

[1] - On eatable part. [2] - On lipid.

The significant quantity of dioxins was founded out in absorbing water of an inceneration unit of chlororganic compounds on a factory "Organica" in Novokuznetsk.

Dioxins are founded in a water of the river Tom. Their levels in the regions of cities Novokuznetsk and Kemerovo are close, that it is impossible to say about the composition of isomers. It means, that at least two sources of dioxins of a various nature are present. Contents of dioxins in drinking water of Novokuznetsk and Kemerovo a little differs from those in the river. The clearing of a water is inefficient for dioxins. Moreover, it is known, that formation of these toxicants is possible using Cl_2 and NaClO for disinfection of water [2].

The large contents of dioxins in snow of Novokuznetsk testifies about the size of dioxincontaining effluents in atmosphere by the enterprises and transport of this city - one of the most polluted in Russia.

Quantity of dioxins in investigated meat and milk is below the norms accepted in Russia, though in case of milk of a state farm located near the plant "Azot"in Kemerovo, their levels are close.

The revealed preliminary picture of dioxins pollution supplemented by result of research of breast milk. Milk contains dioxins in quantity ~ in 10 time exceeding the norm accepted in Russia for milk.

Comparison of levels of the dioxins contents in human milk of Kemerovo and other cities of Russia shows that it more then in Novosibirsk [5], Irkutsk [5] and Ufa [6] and comparable with one of Sterlitamak [6].

As a whole, the received results testify about a dangerous degree of pollution of the area by dioxins. It is necessary to continue of researches of dioxins pollution scales of the region and control for dioxincontaining effluents.

Acknowledgement

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