CONTAMINATION OF THE ENVIRONMENT IN AZERBAIJAN WITH DIOXIN XENOBIOTICS

Mustafa Salakhov, Gulchehra Aliyeva[1], Arif Islamzade[2] and Ayaz Efendiev

Institute of Polymer Materials of the Azerbaijan Republic Academy of Sciences, 373204, Sumgait, Azerbaijan Republic
[1]M.Rasul-zade Baku State University, 370001, Baku, Azerbaijan Republic
[2]United Nations Development Programme, Environmental Rehabilitation of Sumgait, 373200, Sumgait, Azerbaijan Republic

Introduction

One of the main sources of formation of chlorinated and brominated dibenzo-p-dioxins (DBPD) and dibenzofuranes (DBF) which present global danger for civilization is burning of domestic and industrial wastes containing chloro(bromo)organic compounds. Explosions and fires at enterprises where chloro(bromo)organic products are produced, or fires in municipal buildings where construction elements of polyvinylchloride are used are especially dangerous.

It is known that one incinerator of medium capacity (50-200 thousand ton/year) discharges 1-100 g/year of dioxins in a form of gases, volatile ash and slag remaining in furnaces.

In exhaust gases of automobiles using ethylated petrol an average dioxin discharge per one vehicle is from 30 to 540 pkg/km[1].

There were many cases of industrial explosions which resulted in mass poisoning with dioxin[2]. Forest fires during the war in Vietnam in 1961-1972 caused dioxin poisoning and led to numerous deaths, cancer, monstrosity of newborn children, incurable skin diseases, such as chloracne[3].

Results and Discussion

Analysis of chemical methods of preparation of chlorinated and brominated DBDP and DBF shows that these xenobiotics are easily formed from aromatic compounds, in particular, from chloro- or bromophenols[4].

In processes of burning of chlorinated and brominated hydrocarbons of non-aromatic nature, as a result of numerous chemical transformations cyclization takes place which results in formation of benzene halides. E.g. on burning polyvinylchloride, benzene halides are formed which form various dioxins in presence of oxygen[5].

In the Azerbaijan Republic, with its developed chemical, petrochemical and metallurgical industry all sources of dioxin xenobiotics can be found.
Sumgait is one of the regions of the Azerbaijan Republic most polluted with chloro-organic products. Chemical and petrochemical plants are concentrated in Sumgait. Chlorine and chloro-organic products which are used in agriculture and for other purposes are produced here on a large scale.

Organic products were produced during many years. These products and large volumes of industrial wastes contained environmentally dangerous chlorinated dioxins and their precursors that remain in the environment for a long time.

Thus, herbicides (amine salts of 2,4-dichlorophenoxiacetic acid) are produced in Sumgait since 1969. Production output was 15 thousand ton/year. The process of production of 2,4-dichlorophenoxiacetic acid (2,4 D) included the following dioxin sensitive stages:

1. Production of sodium phenolate using neutralization of phenol with caustic
2. Condensation of sodium phenolate with monochloroacetic acid (MCAA) in an alkali medium
3. Chlorination of suspension of phenoxiacetic acid (PAA) with production of 2,4D acid
4. Filtration of 2,4D acid.

Waste process water was formed at the stage of filtration of PAA and 2,4D acid and contained significant amount of phenol, hydrogen chloride, PAA and 2,4D acid. Amount of waste water was 800 m^3/day; 2,4D acid– 3 000 mg/l; HCl – 40 000 mg/l; phenol – 5 500 mg/l; PAA – 7 500 mg/l.

Production of lindane – pesticide for agricultural use began in 1985.

Because of mistakes made when choosing materials for some equipment components during the start-up phase of production there were numerous accidents and outbursts into the environment which resulted in mass dermatological diseases of operators.

Large scale formation of by-products– trichlorobenzene and hydrochloric acid was most critical factor in lindane production, volume of these by-products was 92 % of total amount. The result of toxic action on human organism of lindane and trichlorobenzene, easily dissolved in fatty tissues surrounding nerves is chloracne disease which is induced by by-products- chlorinated dioxins. Lindane production as especially dangerous was closed in Sumgait in 1989.

During the survey at the Sumgait Industrial Association "Khimprom" in July of 1989 soil samples were taken and analysed for 2,3,7,8-tetrachlorodibenzene para-dioxin. Amount of dioxin in the soil samples was 0,1-0,15 μg/kg[6].

Sanitary-hygienic problems in connection with dioxin and related xenobiotics of Caspian sea still need investigation, meanwhile dioxin-contaminated waste water from industrial cities of Russian Federation – Ufa, Volgograd, Dzerzhinsk, Chapayevsk with water of Volga riverfrom

Tbilisi (Georgia) and Yerevan (Armenia)– with water of Kura and Araks rivers flow to the Caspian sea.

Since 1992, *governmental and public organisations of the* Azerbaijan Republic began taking the following measures to prevent dioxin danger in the region:

1. Initiative group of scientists at the Institute of Polymer Materials of Azerbaijan Academy of Sciences was formed and Republician Seminar was held where decision on establishment of Azerbaijan Anti–Dioxin Society was taken. The purpose of creation of Anti-Dioxin society is to inform people about dioxin danger, to provide consulting services and other assistance to interested parties, apply for financial support to international ecological funds for:
   a) chemical monitoring intended for control over territorial changes of xenobiotic concentrations with time;
   b) biological monitoring looking for possible damage to living organisms;
   c) toxicological monitoring, analysis of temporary impact on affected groups of population.
2. Through the State Committee on ecology and control for nature use of the Azerbaijan Republic agreement with the officials of the Azerbaijan International Operating Company (AIOC) has been achieved on dioxin monitoring in the Caspian Sea in oil fields "Azeri", "Chirag" and deep-water part of Guneshli field.
3. Negotiations with UN representation in Azerbaijan, in particular, its main consultant Mr.Philip Tortel on control of dioxin problem within the frame of "Sumgait project" on protection of the environment are periodically carried out.
4. Application has been sent to the Parliament of the Azerbaijan Republic requesting to accept national programme on dioxin problem.
5. Negotiations continue in various organizations about establishment of special laboratory for monitoring of dioxin xenobiotics with complex laboratory of Italian firm "Fizons" in Sumgait.
6. Since 1995-1996 academic year training of personnel for fight with dioxin danger in the Azerbaijan Industrial Institute are carried out. At the Chair "Industrial ecology" educational programmes were prepared and special courses "Halogen–organic compounds and dioxin problem" are delivered, students work on their diplomas, scientific seminars are held[7-9].
7. To improve ecological education, since 1992 through the newspapers, radio and TV people of the Republic are regularly informed about global danger of dioxins and ways of their prevention.
8. Strategy of the concept of "Dynamic spatial thinking in education" has been developed. This strategy at the present stage of development of science and technology requires forms and methods for practical implementation in the process of the environmental studies, according to this strategy ecological vision and thinking should be based on development of spatial structure of the objects of the environment, in particular, establishment of interrelationship between the toxicological activity of chlorinated dioxins and their spatial structure[10].

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