

# THE FORMATION CONDITIONS OF DIOXIN INDUSTRIAL EJECTIONS

*L.V.Pashchenko, T.G.Shendrik, V.A.Khazipov, V.I.Saranchuk*  
*Institute of Physical, Organic and Coal Chemistry National Ukrainian Academy of Sciences*  
*R.Ljuxemburg str., 70, 340114, Donetsk, Ukraine*

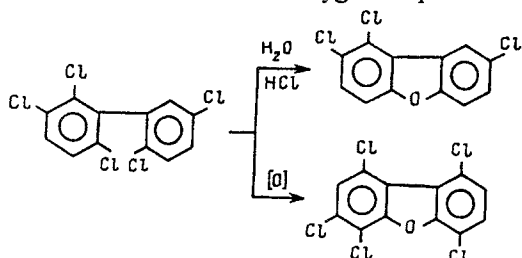
## Introduction

Dioxin are one from the most dangerous chemical compounds for people. The toxic action of 2,3,7,8-tetrachlorodibenzedioxin excels the action of well-known nowadays most intense poisons as cyanide, strychnine and others /1/. Dioxin can accumulate in organism during many years, suppressing the immunity. As the result the derangement, furuncles, malignant swelling originate, the inborn deformities of newborns appear /2/.

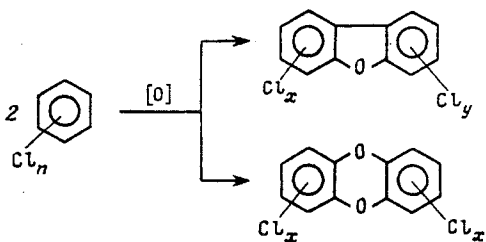
The goal of research is to analyse the most widespread and dangerous sources of dioxin formations in industry.

## Results And Discussion

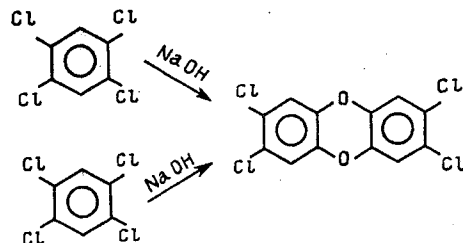
Polychlorbyphenils are the most power sources of dioxin ejections. They widely used for condensers and transformers making. The main dioxin generation takes place under the polychlorbyphenil oxidation by air at the temperatures 600-700°C and oxygen surplus about 8 % /3/.



The different dioxins are formed during the chlor-benzenes pyrolysis at the temperature about 600°C.



The analogous to above-mentioned products are formed from chlorphelols. Dioxins appear during chlorbenzenes transformation in the presence of potassium hydroxide at the temperature higher than 160°C /4/.



Considerable quantity of dioxins are formed during the burning of town rubbish, waste car oil, fuel in power plants and internal combustion engines, on the steel foundries, woodworking enterprises /the stage of cellulose bleaching/, under production of chlorinated organic compounds, pesticides and defoliants, aromatic hydrocarbons oxidation and their further processing in the chlorinate processes, different furnaces on wood and coal burning /5/.

There are non-traditional sources of dioxin formation, for example, the application of active chlorine together with activated coal in the process of water preparation and water purification can lead to the obtaining hydroxided polychlorbyphenols and other dioxins /6/.

Earlier the cokechemical industry was considered as industry without dioxin formation. Now on the base of numerous experiments date and analysis of foreign scientists results it can affirms that dioxin formation is very probably during burning and pyrolysis of such raw material as coal (especially salty coals), because all elements necessary for dioxin formation are present during coal pyrolysis (carbon, hydrogen, oxygen, chlorine) /7/. In view of high chlorine-ione mobility the process of chlorine moving as chloride hydrogen and chlorine-containing compounds from coal is carried out at concerning low temperatures (to 600°C).

In presence of steam-air phase ( during partial contact of coal with air or during air desorption from coal under thermal action ) at the temperatures 700-900°C chlorine-

ions almost completely pass to gaseous phase as chloride hydrogen /8/.

One from the theories of dioxin formation during burning or pyrolysis of carbon materials supposes the obligatory presence of preliminary stage - the formation of molecular chlorine at the contact of chloride hydrogen with oxygen. Formed in the gases chlorine chlorinates the volatile organic products with formation of dioxins. It has been established that ions of copper are the active catalysts of dioxin formation in smoke gases.

There are three regimes of dioxin formation in installations of carbon waste and coals burning: incomplete waste destruction, incomplete burning and recombination of free radicals (20-400 °C) in the cold part of system /9/.

In Ukrainian salty coals (Novomoskovskoe deposit, Western Donbas) the chlorine content achieves 5-10 mg/g on coal mass. Authors established /10/ that during salty coals thermolysis in atmospheres of nitrogen, hydrogen, argon at the temperatures 400-900 °C chlorine is eliminated in the form of chlorine hydroxide. The degree of chlorine elimination depends on atmosphere and process temperature. In the CO<sub>2</sub>-atmosphere chlorine from salty coals at 400-900 °C is emitted in Cl<sub>2</sub>-form, for all that its quantity is decreased with the temperature increasing. These data lead to the mind about high possibilities of chlorine-organic compounds formation during, for example, salty coals activation in CO<sub>2</sub>-atmosphere at high temperatures (800-900 °C). With other hand, the investigated coals have Ti concentration 0.01-0.02 % wt, and on this TiO<sub>2</sub>-crystalline surface under the light influence the easy destroying dioxins take place /11/. There are other possibilities for decreasing probability dioxins formation during salty coals utilization. For instance, these are preliminary desalting salty coals with leaching, or pelleting /12/ or alkaline hydrolysis. These opportunities are in the working up now by us.

In Ukraine the zones with dangerous dioxin content are not determined. The reasons of this are the absence of experimental base, publicity and necessary assignments for carrying out investigations.

For decreasing of dioxin ejections it has been proposed different chemical, physical and microbiological methods. It is used the effective systems of catching and destruction of dioxins. In developed industrial countries the installations are exploited for decreasing of dioxin ejections. One

from the most effective technologies is the regime of the high-temperature waste burning in rotatable furnaces at the temperature 1000-1200 °C. The technology of cleaning of smoke gases obtained at solid rubbish burning is very

practically interesting, because the introduction of ammonia in burning products decreases the probability of dioxin formation on 76 % /13/.

## Conclusions

The most widespread and dangerous sources of dioxin formation in industry have been analysed. The possibility of dioxin formation in conditions of cokechemical industry and salty coals thermal processing has been considered. The characteristics and toxic influence of dioxins on people has been described.

## References

1. King H.H., Stock L.M. *Fuel*, 1982, 61, p.257.
2. Khazipov V.A., Galushko L.Ya., Pashchenko L.V., Saranchuk V.I. *Chimiya tverdogo topliva*, 1995, 4, p.67-72.
3. Katritzky A.R., Balasubramanian M., Siskin M. *Energy and Fuels*, 1990, 4, p.499.
4. Zhicheng Bao, Xianglan Ding, Zhang Zun. *Environ. Chem.*, 1990, v.9, 6, p.29-32.
5. Natscher R. *Umwelt*, 1986, 5, p.398-400.
6. Voudrias Evangelos A., Larsen Richard A., Snoeyink Vernin L. *Water Res.*, 1985, v.19, 7, p.909-915.
7. Sander H.P. *VDI.-Ber.*, 1987, 634, p.37-51.
8. Griffin Roger D. *Chemosphere*, v.15, 9, p.1987-1990.
9. Haltiner E.W. *Verfahrenstechnik*, 1990, v.24, 7-8, p.10-11.
10. Shendrik T.G., Simonova V.V., Afanasenko L.Ya., in *Coal Science 95 (Ext. Abstr. 8th Int. Conf. Coal Science)*, Oviedo, Spain, 1995, p.823-827.
11. Pelizzetti E., Carlin Y., Minero C., *New Y. Chem.*, 1991, v.15, 5, p.351-352.
12. Beletskyi V.S., Shendrik T.G., Khelufy A., in *Coal Structure 96 (Book of Abstr. Int. Conf. Coal Structure)*, Krakov, Poland, 1996, p.122.
13. Tacacs Laszilo, Moilanen George L. *Air and Waste Manag. Assoc.*, 1991, v.41, 5, p.716-722.