# Simultaneous high temperature treatment of pasty, solid and liquid wastes containing chlororganic matters with production of secondary mineral products

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On Dioxin-94 Symposium we had presented the short paper about high temperature treatment of dioxin-containing slurries of "Chimprom" state enterprise (Upha) with production of ecologically pure cement [1].

The present work is devoted to investigation of simultaneous high temperature disposal of three types of Dzerzhinsk enterprises (Nizhny Novgorod Region) toxic wastes: (a) pasty wastes - slurry of sewage treatment plants of "Caprolactam" chemical plant; (b) liquid chlororganic wastes of the same enterprise; (c) slag and fly ash of Igumnov steam electric station working on solid fuel.

The raw mixture of the slurry, the fly ash and the slag was previously prepared. The mixture had the following composition, weight %: moisture content - 63.0; ash content - 35.15; organic chlorine - 1.1; total sulphur - 0.05; organic carbon $C^P$ - 0.55; organic hydrogen $H^P$ -0.04; organic oxygen $O^P$ - 0.11. Content of PCDD and PCDF in the mixture was 0.596 hg/kg of TEQ.

The liquid chlororganic waste had the following composition, weight %: moisture content - 17.9; ash content - 2.3; carbon $C^P$ - 38.8; hydrogen $H^P$ - 2.67; total chlorine $Cl^P$ - 24.7; oxygen $O^P$ - 13.63. Dioxins and furans were absent in the chlororganic waste.

The experiments devoted to the high temperature treatment of the wastes of all the types were carried out at the semi-commercial plant for cement production, which consisted a drum rotary furnace with aggregate product capacity of 100 kg/h [1]. This plant is placed in Podolsk, Moscow Region.

The first experiment was carried out with feeding only the raw mixture, containing the slurry, the fly ash and the slag. During the second experiment the liquid chlororganic waste was added into the raw mixture in the quantity of 1.4% of the raw mixture dry mass.

During the third experiment the liquid chlororganic waste was fed in the furnace through a nozzle together with liquid fuel in the quantity of 0.7% of the raw mixture dry mass.

The temperature of the drum rotary furnace (in the fuel feeding zone) during all three experiments practically did not change and was 1400~1450°C.

The temperature of the fuel gas of the furnace (in the raw mixture feeding zone) was 450~520°C. Under these conditions the composition of the cement clinker practically remained constant during all the experiments. The content of the free calcium oxide in it was 0.2~0.5%, and the content of the mineral chlorine in the form of $CaCl_2$ - 0.8~0.9%. The average content of PCDD and PCDF was 0.008 ng/kg of TEQ. The generated product corresponded to PC 400 DO Portland cement mark.

The Table shows the results of the flue gas analysis. As it evident from the data of the table the concentrations of some toxic components in some degree exceed the rigid standards for emissions established for example in Germany (according to 17 Blm SchV CO $\leq$ 50 mg/m$^3$; NO $\leq$ 200 mg/m$^3$; HCl $\leq$ 10 mg/m$^3$ ; $SO_2$ $\leq$ 50mg/m$^3$; PCDD+PCDF $\leq$ 0.1 ng/m$^3$).

During erection of the full-scale plant in Dzerzhinsk it is necessary to provide an additional treatment of the flue gas, namely, its oxidation and neutralization in a special afterburning chamber.

On the whole the experiments revealed the possibility of ecologically efficient simultaneous high temperature treatment of liquid chlororganic wastes, slurries and solid waste from coal combustion at power stations with receiving commercial cement.

Reference

1) Bernadiner M.N., Sanphirov E.S., Zhizhin V.V., Crivoborodov Yu.R., Zhelezhiak V.J., Terentiev V.C., Geraseva M.P., Samsonov D.P.
High temperature destruction of dioxin-containing slurries with production of secondary products.

Table
Results of the flue gas analysis

| Dry flue gas components | Units | Run №№ | | |
|---|---|---|---|---|
| | | N1 | N2 | N3 |
| $CO_2$ | % vol. | 5.6 | 4.3 | 3.6 |
| $O_2$ | % vol. | 11.4 | 14.3 | 15.4 |
| CO | mg/m³ | 250 | 80 | 75 |
| $NO_x$ | mg/m³ | 31 | 140 | 102 |
| HCl | mg/m³ | 33 | 45 | 75 |
| $SO_2$ | mg/m³ | - | - | - |
| 2,3,7,8-TeCDD | ng/m³ | - | - | - |
| 1,2,3,7,8-PeCDD | ng/m³ | 0.062 | 0.067 | - |
| 1,2,3,4,7,8-HxCDD | ng/m³ | 0.042 | 0.028 | 0.063 |
| 1,2,3,6,7,8-HxCDD | ng/m³ | 0.052 | 0.062 | 0.071 |
| 1,2,3,7,8,9-HxCDD | ng/m³ | 0.074 | 0.028 | 0.045 |
| 1,2,3,4,6,7,8-HpCDD | ng/m³ | 0.164 | 0.251 | 0.290 |
| OCDD | ng/m³ | 0.229 | 0.306 | 0.897 |
| 2,3,7,8-TeCDF | ng/m³ | - | - | - |
| 1,2,3,7,8-PeCDF | ng/m³ | 0.192 | - | - |
| 2,3,4,7,8-PeCDF | ng/m³ | 0.228 | 0.108 | 0.152 |
| 1,2,3,4,7,8-HxCDF | ng/m³ | 0.273 | 0.251 | 0.288 |
| 1,2,3,6,7,8-HxCDF | ng/m³ | 0.232 | 0.272 | 0.355 |
| 1,2,3,7,8,9-HxCDF | ng/m³ | - | - | - |
| 2,3,4,6,7,8-HxCDF | ng/m³ | 0.213 | 0.303 | 0.264 |
| 1,2,3,4,6,7,8-HpCDF | ng/m³ | 0.637 | 0.660 | 0.786 |
| 1,2,3,4,7,8,9-HpCDF | ng/m³ | 0.013 | 0.020 | - |
| OCDF | ng/m³ | 0.159 | 0.204 | 0.572 |
| 1-TEQ | ng/m³ | 0.186 | 0.250 | 0.195 |

$O_2$ concentration in dry gas 11%