Effects of Combusting Plastics in WTE Plants on Dioxin Formation and Ash Quality

J. Vehlow, F.E. Mark*
Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany
Institute for Technical Chemistry – Division of Thermal Waste Treatment
*Dow Europe, Horgen, Switzerland

<table>
<thead>
<tr>
<th>plastic material</th>
<th>components of interest</th>
<th>conc. in MSW in wt-%</th>
<th>max. addition in wt-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>mixed plastics*</td>
<td>Cl HM PCDD/F</td>
<td>3 - 7</td>
<td>20</td>
</tr>
<tr>
<td>PVC</td>
<td>Cl Cu PCDD/F</td>
<td>0.1 – 0.4</td>
<td>4</td>
</tr>
<tr>
<td>ASR*</td>
<td>ash quality</td>
<td>~ 0</td>
<td>30</td>
</tr>
<tr>
<td>PUR/XPS foams*</td>
<td>Br (F)</td>
<td>~ 0</td>
<td>3</td>
</tr>
<tr>
<td>WEEE (9 materials)</td>
<td>Br HM PXDD/F</td>
<td>~ 0</td>
<td>25</td>
</tr>
</tbody>
</table>

* add. full scale tests

co-combustion programs

J. Vehlow, ITC-TAB (2003)
**partitioning of chlorine**

\[ \text{Br}_2 + \text{SO}_2 + \text{H}_2\text{O} \rightarrow 2\text{HBr} + \text{SO}_3 \]

**bromine speciation in the raw gas**
percent partitioning of metals in waste incineration

influence of halogens and fuel bed T on Zn volatilisation
influence of Cl and Br on Cu volatilisation

dioxins 75
furans 135

polychlorinated dibenzo-p-dioxins and dibenzofurans
PCDD/F formation in waste incineration

**ingredients:**
- PICs (e.g. soot)
- halogenides (Cl−)
- catalysts (Cu)

**conditions:**
- oxidising atmosphere
- T > 200 °C
monitoring of the combustion process

- online-analysis of O₂, CO₂, CO, H₂, CH₄, C₆H₆, N species, calorific value
- sampling of PAH, PCDD/F, metals

failure in combustion control

- integral above the fuel bed
- inside the first flue
- downstream the boiler
congeners:
- chlorinated: 210
- brominated: 210
- mixed halogenated: 5020

polyhalogenated dibenzo-p-dioxins

congeners:
chlorinated 210
brominated 210
mixed halogenated 5020

concentrations of PXDD/F in the TAMARA raw gas
mass balance of a waste incinerator (stoker furnace)

residual carbon in bottom ash
PCDD/F in bottom ash

heavy metals in bottom ash
pH value in bottom ash

Pb elution in bottom ash
test on pretreated and aged bottom ashes (German DEV S4)

J. Vehlow, ITC-TAB (2003)

test on combined ash (TCLP test)

J. Vehlow, ITC-TAB (2003)
test on fresh bottom ash (TCLP test)

Dutch column leaching test for Cu on aged bottom ashes
conclusions from plastic co-combustion tests

- co-combustion with MSW is an acceptable disposal route for limited amounts of plastics with even high halogen levels

- high halogen inventories cause an increased volatilization of various heavy metals into the fly ashes

- there is no increased formation of halogenated dioxins or furans provided a good burnout is achieved

- the leaching stability of bottom ashes is not significantly altered

conditions:

- good mixing of the fuel materials

- good combustion control