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Environmental aspects of side stream applications

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UBA – III 2.1 Cross-sectorial Aspects of Pollution Control, Chemical Industry, Combustion Plants
Content

1. Introduction
2. Waste management strategies and legislation
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Introduction - Waste balance of Germany

Waste Balance
(Total waste amount 2009: 322 Mio. t)

- Household waste: 60.51%
- Wastes resulting from mining and treatment of mineral resources: 8.55%
- Commercial waste: 15.91%
- Construction and demolition waste: 13.41%
- Other municipal waste: 1.62%
Introduction (2)
Disposal routes of municipal solid waste of EU 27 countries

Source: Recycling and Waste-to-Energy in combination for sustainable waste management; CEWEP; October 2011

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Options for material recycling of paper mill residues and factors governing treatment options

- Material recycling
  - brick work
  - cement industry
  - building industry
  - road building
  - mining industry
  - iron and steel industry
  - agriculture (land-spreading)
  - composting
  - land reclamation
  - composites
  - biorefinery...

- Competition with residues from other industries
- Costs
- Continuity of taking over the residues
- Transport
- Waste management strategies and legislation
- Pollutants, limit & target value
- Public awareness
- Market acceptance image of the product
- Local infrastructure, availability of suitable installation

Source: Hamm 1996, modified in PP BREF 2014
Waste management strategies and legislation
Directive 2008/98/EC on waste

basic concepts and definitions related to waste management
• Definitions of waste, recycling, recovery
• Following polluter pays principle, extended producer responsibility
• Waste management hierarchy - Prevention of downcycling
Waste management strategies and legislation
Directive 2008/98/EC on waste (2)

Explanation when waste ceases to be waste (art. 6)
- End of waste criteria for glass and scrap
- Failed for paper for recycling

Distinguishes between waste and by-products (art. 5)
(a) further use is certain;
(b) can be used directly without any further processing;
(c) is produced as an integral part of a production process and
(d) the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.
Waste management strategies and legislation
Directive 2008/98/EC on waste (2)

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Waste management strategies an legislation
Circular economy package EU – closing the loop?

- Sets targets for reduction of wastes
- Should lay out the long term frame for waste management and recycling in the EU
- Includes some measures for reduction of waste

Positive signals:
- Including aspects of recyclability in Ecodesign Directive
- Elaboration of monitoring program for obsolescence
- Prevention of food waste
- Development of missing standards for secondary material
- Improvement of plastic recycling
- 10% landfilling of domestic waste by 2030
- Separate collection of bio waste
Waste management strategies and legislation
Circular economy package EU – closing the loop? (2)

→ level playing field at a low ambitious level - stops innovation
  • Low level of ambition for countries with highly developed waste management systems (DE, BE, NL, DK), for other member states the level of ambition is high.

Every strategy is only as good as its execution!
  • Only few quantified targets (e.g. for household waste) but numerous appellative measures, implementation plans are missing
  • Conflicts between increasing the recycling and accumulation of pollutants in material cycles are not addressed
  • Focusses too much on end of life (consumer) rather than on management of residues from industrial production
  • Experienced downcycling is not addressed, cascading utilization should be promoted
  • Focus too much on security of supply and economic efficiency - environmental aspects are missing
  • Inter-linkages of circular economy, resource efficiency and climate change mitigation are obvious → no connection to EU-Resource roadmap
Waste management strategies and legislation national and local requirements

Fulfillment of:

- **product protection requirements** e.g.
  - Fertilizer Ordinance, Biowaste Ordinance
  - quality standardization of construction material, compost and secondary fuels
- **environmental protection requirements** e.g.
  - regulation on protection of air, water and soil
- **and health protection requirements** e.g.
  - maximum permissible workplace concentration (MAK values)
  - REACH and CLP regulation
- **Ban on the mixing of hazardous waste** (art. 18 WFD)

→ „Dilution is no solution!“
Waste management strategies and legislation national and local requirements (2)

Netherlands

WASTE DOES NOT EXIST!

- It does not matter what goes in, it is only important that nothing goes out.
- e.g. criteria for leaching
- Screen glas used for the production of concrete elements – concrete elements may contain up to 2% PbO, 1,7% SrO; 2% BaO

Germany

- Residue itself has to fulfill all quality requirements before it is allowed to be used for certain purpose
- Specific contructional function of the utilisation has to be proven
- Prevention of spreading of contaminats in the environment that might be found harmful at a later stage
- Concentrated and controlled sinks for pollutants are prevered
- Fly ash of incineration of deinking sludge with elevated copper content but eluat value below 10 µg/l → not allowed to be used as filler for the production of sand-lime bricks
Pollutant, limit & target values
International quality standard (CEN EN 15359) for RSF

<table>
<thead>
<tr>
<th>Classification property</th>
<th>Statistical measure</th>
<th>Unit</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net calorific value (NCV)</td>
<td>Mean</td>
<td>MJ/kg (ar)</td>
<td>1</td>
</tr>
<tr>
<td>Chlorine (Cl)</td>
<td>Mean</td>
<td>% (d)</td>
<td>1</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>Median 80th percentile</td>
<td>mg/MJ (ar)</td>
<td>1</td>
</tr>
</tbody>
</table>

Example of classification:
NCV of 19 MJ/kg, mean chlorine content of 0.5% and a median mercury content of 0.016 mg/MJ:
class code NCV 3, Cl2, Hg2
Pollutant, limit & target value
Quality level for recovered secondary fuel

**German quality standard (RAL-GZ 724)**

- Define NCV and grain size
- Low chlorine content
- Low heavy metal concentration

**Availability**

- Adequate
- Constant quality

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>RAL-GZ 724 [mg/kg TS]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cd</td>
<td>4</td>
</tr>
<tr>
<td>Hg</td>
<td>0.6</td>
</tr>
<tr>
<td>Tl</td>
<td>1</td>
</tr>
<tr>
<td>As</td>
<td>5</td>
</tr>
<tr>
<td>Co</td>
<td>6</td>
</tr>
<tr>
<td>Ni</td>
<td>25/80</td>
</tr>
<tr>
<td>Se</td>
<td>3</td>
</tr>
<tr>
<td>Te</td>
<td>3</td>
</tr>
<tr>
<td>Sb</td>
<td>25</td>
</tr>
<tr>
<td>Pb</td>
<td>70 / 190</td>
</tr>
<tr>
<td>Cr</td>
<td>40 / 125</td>
</tr>
<tr>
<td>Cu</td>
<td>120 / 350</td>
</tr>
<tr>
<td>Mn</td>
<td>50 / 250</td>
</tr>
<tr>
<td>V</td>
<td>10</td>
</tr>
<tr>
<td>Sn</td>
<td>30</td>
</tr>
<tr>
<td>Be</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Im Mittel $u_{FS}$: 17.5 MJ/kg
## Pollutant limit & target values

### Heterogeneous composition of deinking sludges

<table>
<thead>
<tr>
<th>Component</th>
<th>Unit</th>
<th>Contents per kg dry solids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Deinking sludge (1)</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>mg</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>mg</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>mg</td>
<td><strong>350</strong></td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>mg</td>
<td>350</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>mg</td>
<td>35</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>mg</td>
<td>5</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>mg</td>
<td>20</td>
</tr>
<tr>
<td>PCBs</td>
<td>µg</td>
<td>95</td>
</tr>
<tr>
<td>Chlorophenols</td>
<td>µg</td>
<td>75</td>
</tr>
<tr>
<td>Volatile solids</td>
<td>% DS</td>
<td>ND</td>
</tr>
</tbody>
</table>

**ND** = not determined

(1) Dutch notes on BAT 1996
(2) Representative sampling from a German paper mill
(3) A synopsis of the complete results of chemical analysis of solid wastes from paper manufacturing conducted at German PTS, published in, solid waste handbook 1996
Public awareness, market acceptance, image of a product

Composting, spreading in agriculture, flower soil
- not accepted in some areas by the public
- even though limits of harmful substances (heavy metals) are kept below the limit

Content of critical mineral oil components in packaging made out of waste paper
- is not accepted by authorities and the public
Conclusions

• Development of a waste management system and plans recognizing the following aspects:
  – Waste reduction at source has first priority
  – Comprehensive examination of rejects is essential
  – Find the utilisation at the highest quality stage with a good overall life cycle performance
  – Design products that are recyclable after use again….
Thank you for your attention

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http://www.umweltbundesamt.de/themen/abfallressourcen/abfallwirtschaft