Solid waste / waste water of the German paper industry – their disposal and reuse

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Solid waste of the German paper industry in 2006

Total amount: 4 million tons (estimated)

- Deinking sludges: 30%
- Other residues: 1%
- Incineration residues: 15%
- Bark: 11%
- RP rejects: 1%
- WTP sludges: 31%
- PF rejects: 1%

RP: recovered paper processing
PF: primary fibre processing
WTP: waste water- / process water treatment plant
Utilization and disposal of solid waste of the German paper industry in 2004

Total amount: 3.6 million tons

- In-mill energy recovery: 36%
- Composting: 7%
- Other biological utilization: 4%
- External energy recovery: 13%
- Landfilling: 7%
- Other utilization: 2%
- Other use for construction materials: 7%
- Cement industry: 7%
- Brick industry: 17%
Utilization and disposal of solid waste of the German paper industry from 1987 to 2004

Proportion in % by weight

Landfilling | Biological utilization | Construction material | Energy recovery | Other utilization
---|---|---|---|---
1987 (Old Federal States): 51, 19, 13, 13, 22, 50
1990: 43, 10, 10, 21, 31, 49
1992: 27, 6, 11, 21, 31, 49
1994: 16, 10, 20, 24, 22, 38
1997: 15, 20, 22, 23, 50, 38
2001: 18, 7, 21, 26, 26, 35
2004: 19, 2, 15, 38, 5, 2

Fig. 4
Landfilling of solid waste of the German paper industry in 2004

*Fig. 5*

**Total amount: 250,000 tons**

- **RP rejects**: 34%
- **Incineration residues**: 36%
- **WTP sludges**: 2%
- **Deinking sludges**: 28%

RP: recovered paper processing
WTP: waste water-/ process water treatment
Processing rejects and ragger ropes to waste derived fuel
Costs of solid waste disposal in Germany in 2006/2007 in €/ton
(black: rejects; blue: sludge)
Small-scaled reject incineration plant with grate firing
Average Specific Waste Water Volume of the German paper industry
**Fresh water consumption**

- Introduction of save-all equipment (sedimentation, filtration, flotation) and the separation of white water and solids (fibres, fillers)
- Installation of sufficient process water storage
- Separation of streams of different water quality
- Counter-flow of clean water from paper machine
- Installation of in-line-kidneys
- All-over improved process design
- Use of more efficient machinery
Spec. Waste water volume of different paper grades of the German paper industry in 2004

Fig. 11
Figures based on Production Volume

Types of effluent discharge in the German paper industry in 2004

- Directly discharged without biological treatment: 6%
- Closed circuit effluent-free: 4%
- Indirectly discharged: 15%
- Directly discharged with biological treatment: 75%
Comparison of BREF-BAT level with annual average emission of German RCF mills producing corrugating medium and testliner (2006)
Comparison of BREF-BAT level with annual average specific waste water volume of German RCF mills producing corrugating medium and testliner (2006)
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>BREF-BAT</th>
<th>German Mills (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>COD</td>
<td>kg/t of paper</td>
<td>0.5 – 1.5</td>
<td>0.52</td>
</tr>
<tr>
<td>BOD₅</td>
<td>kg/t of paper</td>
<td>&lt; 0.05 – 0.15</td>
<td>0.01</td>
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<tr>
<td>TSS</td>
<td>kg/t of paper</td>
<td>0.05 – 0.15</td>
<td>0.001</td>
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<tr>
<td>AOX</td>
<td>kg/t of paper</td>
<td>&lt; 0.005</td>
<td>0.0003</td>
</tr>
<tr>
<td>Total P</td>
<td>kg/t of paper</td>
<td>0.002 – 0.005</td>
<td>0.002</td>
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<tr>
<td>Total N</td>
<td>kg/t of paper</td>
<td>0.02 – 0.05</td>
<td>0.003</td>
</tr>
<tr>
<td>Waste water amount</td>
<td>m³/t paper</td>
<td>&lt; 7</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Comparison of BREF-BAT levels of biological treated effluents for RCF packaging paper mills with annual average emission and consumption levels of German paper mills (2006)
Effluent-free Process Water System of Smurfit Kappa
Zülpich Mill, Germany
• German paper industry has reached a good level on environmental protection

• Future challenge in solid waste management: treatment and incineration of plastic-containing rejects from recovered paper processing

• Need for incineration technologies for smaller units

• German paper industry has reached a very low level in fresh water consumption

• Experiences with totally closed water circuits are not yet satisfactory. Further optimisation is required
• Projected onto the entire German paper production (24 million tons) a total of 4.0 million tons of waste (rejects, sludges) can be assumed in 2006. This volume refers to the wastes in their original state.

• Most wastes from paper manufacturing contain a high proportion of organic substances. A disposal by dumping was not longer possible since 2005.

• Increased utilisation of waste for energetic and building material purposes.

• Energetic utilisation in power plants is of special importance for high-caloric rejects from recovered paper processing.

• Biological utilisation (composting, land spreading) will drop significantly due to declining acceptance and changed legislation (biowaste Ordinance).