Impact of the wood-based industry on the environment

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European wood processing industry

2007 (EC27): 230 bill. € / 2,3 M persons / 340,000 factories

Europe 2007:
- 220 PB-mills (45 M m³)
- 90 MDF-mills (15 M m³)
- 14 OSB-mills (4 M m³)
- 100 PY-mills (3 M m³)
- 70 GLT-mills (4 M m³)
- 60 Solid boards (1 M m³)
- 250 Pellets mills (4 Mio. t)

Construction timber incl.
- Parquet 20%

Sawing, planing, impregnation
- 12%

Wood-based panels
- 9%

Furniture
- 51%

Other
- 5%

Packaging
- 3%
### VOC in the wood based panels industry

<table>
<thead>
<tr>
<th>Source of pollution</th>
<th>Impact on Environment</th>
</tr>
</thead>
</table>

#### Properties (mainly)

<table>
<thead>
<tr>
<th>Low - molecular</th>
<th>Mid - molecular</th>
<th>High - molecular</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood related representative substances</strong></td>
<td><strong>Formaldehyde, Phenol, Ammonia, Alcohols, Carboxylic acid, etc.</strong></td>
<td><strong>Terpenes, Pinens, Caren, Limonen, Myrcen, common Ligneous Aromatics, etc.</strong></td>
</tr>
<tr>
<td><strong>Physical Condition</strong></td>
<td>gaseous</td>
<td>mainly gaseous</td>
</tr>
<tr>
<td><strong>Water solubility</strong></td>
<td>hydrophilic</td>
<td>partial</td>
</tr>
<tr>
<td><strong>Odour threshold</strong></td>
<td>very low</td>
<td>higher</td>
</tr>
<tr>
<td><strong>Odour nuisance</strong></td>
<td>strong nuisance, pungent smell by water solubility</td>
<td>Typical wood smell, aromatic oxidation and absorption</td>
</tr>
<tr>
<td><strong>Separation Possibilities</strong></td>
<td>by water solubility</td>
<td></td>
</tr>
</tbody>
</table>
Sources of waste water and air in MDF process

- **Waste Water Treatment**
  - Effluent water squeezed out by the in-feed plug is recycled back to the chipwasher.
  - Hot press waste air exhausting
  - Hall and press air exhausting

- **Exhaust Air Treatment**
  - Off-gas from energy plant used for the oil, dryer direct heating and steam generation

**Sources of pollution**

Remove of extern debris: stones, sand, earth, fines

**Impact on Environment**
Energy production

Energy flow in MDF plants

Impact on Environment
Modern energy plant for MDF
Fiberboard, Baruth: 90 MWh

Fuel characteristics:
- All wastes from the MDF and Flooring lines

Combustion systems:
- Grate firing: 46 MWth
  (60m² 16 t/h bark at 40-100% m.c.)
- Dustburner MDF dust: 24 MWth
- Dustburner Flooring dust: 24 MWth
- Gas: 58 MWth

Energy output:
- Hot gas: 40 MWth
- Thermal oil: 50 MWth

USE of HOT GASES (770,000 Nm³/h):
- 50% direct for fiber drying
- 50% for thermal oil heating:
  - 20% continuous hot press
  - 55% steam generation (refining)
  - 15% short cycle press
  - 10% halls heating

SNCR (sequentielle nicht Katalytische Reduktion) = Entstickung mittels Harnstoff - NOx Wert vermindert und optimaler Ausbrand!
Regulations for waste air emissions level

<table>
<thead>
<tr>
<th></th>
<th>TA – Luft</th>
<th>IPPC</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter</td>
<td>15mg/Nm³wet</td>
<td>20mg/Nm³dry</td>
<td>VDI 2066/1</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>20mg/Nm³dry ¹)</td>
<td>20mg/Nm³dry</td>
<td>VDI 3862/6</td>
</tr>
<tr>
<td>VOC/COV - dryer</td>
<td>300mg/Nm³wet</td>
<td>130mg/Nm³wet</td>
<td>EN 12619 (FID)</td>
</tr>
<tr>
<td>VOC/COV - press</td>
<td>0.06kg/m³produced panel</td>
<td>130mg/Nm³wet</td>
<td>EN 12619 (FID)</td>
</tr>
<tr>
<td>O₂ Correction</td>
<td>Drying process generally 17%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Odor</td>
<td>--</td>
<td>--</td>
<td>EN 13725</td>
</tr>
<tr>
<td>Blue Haze</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

¹) Class 1 substances (including acetaldehyde, formic acid, acetic acid)
Reachable precipitation rate for particles

- Fabric filter
- Wet electrofilter
- Dry electrofilter
- Washer (quench)
- Cyclone

Requirements

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Combined waste water and air treatment plant

1. MDF-waste water
   - Waste water tank
   - Clarifier
   - Activated sludge tank
   - Flotation
   - Precipitation flocculation

2. Multimedia filter
   - Temperature conditioning
   - pH-conditioning
   - 5 μm-Filter
   - Reverse Osmosis

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Treatment process
General flow of waste air treatment

- Waste air from dryer
- Quench
- Biowave Activated Sludge Treatment
- Improvement of transmitting Formaldehyde
  - Quenche (Washer)
  - Bioscrubber
- Dust- / Aerosolremoval
  - WESP

Clean Air
Wet Electrostatic Precipitator (WESP)

3 steps treatment:
- spraying system
- bio-scrubber
- WESP

Thermophilic activated sludge population (45-60°C)

Combination with waste water treatment (100,000 pax. unit)
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Construction of Quenche

Waste air from dyer

Quenche

Clean air

Biowave (Belebungsbecken)

Nozzels fields and waste air pipe

[Portenkirchner]
Impact on Environment
Construction of BioScrubber
Construction of BioScrubber

Waste air from dryer

Quenche

Biowave (Belebungsbecken)

Clean air

Rotational blaster

[Portenkirchner]
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Construction of WESP

Waste air from dryer

Quenche

Biowave (Belebungsbecken)

Clean air

Wet electrostatic precipitator

C.M.Barbu 11.11.08 SWST 51st
Construction of WESP

- Waste air from dryer
- Quenche
- Scrubber
- Biowave (Belebungsbecken)
- Clean air
- High voltage unit

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Treatment equipment
Construction of WESP

Waste air from dryer

Clean air

Quenche

Biowave (Belebungsbecken)

Treatment equipment

Impact on Environment
## Results of waste water treatment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Waste water</th>
<th>Output active sludge</th>
<th>Output flotation</th>
<th>Output RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD [mg/l]</td>
<td>7000</td>
<td>3000</td>
<td>1000</td>
<td>30</td>
</tr>
<tr>
<td>HCHO [mg/l]</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>N-NH₄</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Conductivity [μS/cm]</td>
<td>1400</td>
<td>2400</td>
<td>2800</td>
<td>80</td>
</tr>
<tr>
<td>pH</td>
<td>5,5</td>
<td>6,9</td>
<td>4,5</td>
<td>4,5</td>
</tr>
</tbody>
</table>
Benefits for waste water treatment

• adaptation of bio-sludge on environment
• increase COD reduction (60%)
• low excess sludge
• increased foaming and bulking tendencies
• high rate of living organisms
• high resistance against variation of T, pH, conductivity
• high stability from biological point of view
• no need of continuous chemical dosage (except anti-foaming agent)
# Results of waste air treatment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Clean air [mg/m³]</th>
<th>Reduction [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>5</td>
<td>82 %</td>
</tr>
<tr>
<td>Dust</td>
<td>3</td>
<td>91 %</td>
</tr>
<tr>
<td>Organic acids</td>
<td>0,9</td>
<td>97 %</td>
</tr>
<tr>
<td>Organic C</td>
<td>15</td>
<td>65 %</td>
</tr>
<tr>
<td>Blue haze</td>
<td>invisible</td>
<td></td>
</tr>
</tbody>
</table>

- Proven application at industrial scale
- Process innovations:
  - Combination waste water & air treatment
  - Combination activated sludge & reverse osmosis, and use of thermophile aerobe biology
  - Closed waste water cycle
- Emission level reduced
- Further modification for other application
Optical effect of WESP (bluehaze reduction)

Without WESP

With WESP