Material Distribution in Treated MSWI Bottom Ash Fractions

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  – Municipal Solid Waste Incineration Bottom Ashes (MSWI BA)
  – Dutch legislation

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Municipal Solid Waste Incineration (MSWI)

- Volume reduction: 90%
- Mass reduction: 70%

**Bottom Ashes (BA)**
- 80 mass %

**Fly Ashes**
- 20 mass %

Chimenos et al, 1999
Municipal Solid Waste Incineration Bottom Ash (MSWI BA)

- After pre-treatment
- Problematic contaminants (Soil Quality Decree)
  - Aluminum
  - Barium
  - Copper
  - Molybdenum
  - Chlorides
  - Sulphates
Dutch building material legislation

- **Shaped**
  - $> 50 \text{ cm}^3$
  - Virtually no erosion or wear

- **Unshaped**
  - $< 50 \text{ cm}^3$
  - Not sustainable rigid
  - Limited emission to the environment

- **Isolated, controlled & monitored materials**
  - Unshaped building materials
  - High emissions to the environment
Changing Dutch legislation: Green deal

- Isolated, controlled & monitored materials

- 2020: 100% freely applicable building material
  - Shaped
  - Unshaped
  - Isolated, controlled & monitored materials
Municipal Solid Waste Incineration Bottom Ash (MSWI BA)

- Alternative applications are needed:
  - Vast production quantities,
  - Limited application as a road base material (Netherlands),
  - Landfilling taxes,
  - Stricter legislation.

- BA has comparable properties to those of raw materials applied in building materials

- BA has the potential to be modified to fit this application.
Methodology

• Particle Size Distribution
  – Dry sieving

• Manually sorting fractions
  – Based on appearance

• Specific density
  – He pycnometer

• Water permeable porosity
  – Hydrostatic weighing
Results

- Particle size distribution MSWI BA 0-40 mm
MSWI BA fractions >4 mm

<table>
<thead>
<tr>
<th>Particle size (µm)</th>
<th>Mass %</th>
</tr>
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<tbody>
<tr>
<td>4000</td>
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</tr>
<tr>
<td>5600</td>
<td></td>
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<tr>
<td>8000</td>
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<tr>
<td>11200</td>
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<tr>
<td>16000</td>
<td></td>
</tr>
<tr>
<td>22400</td>
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</tbody>
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- **Unburned**
- **Ceramic and stone**
- **Glass**
- **Metal**
- **Minerals extractable**
- **Minerals not extractable**
- **Minerals extractable by magnet**
- **Minerals not extractable by magnet**
MSWI BA fractions >4 mm: porosity

Extraneous minerals:
- Unburned
- Glass
- Ceramic and stone
- Metals
- Minerals

Extractability by magnet:
- Minors - Not extractable
- Minors - Extractable
- Glass
- Ceramic and stone
- Metals

Unburned (m%)
- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

Ceramic & Stone

Minerals extractable by magnet

Particle size (µm):
- 4000
- 5600
- 8000
- 11200
- 16000
- 22400

Volume (%):
- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

Metal

Minerals - High ferromagnetic

Minerals - Low ferromagnetic

Pores mineral - Not extractable

Pores mineral - Extractable

Pores glass

Pores ceramic and stone

29/06/2016
Particle size distribution of sorted material fractions
Porosity size distribution of sorted material fractions
Specific density of MSWI BA material fractions > 4 mm

![Graph showing specific density vs. particle size for different categories: Ceramic and stone, Glass, Mineral - Not extractable, and Mineral - Extractable.](image)

- Ceramic and stone: $R^2 = 0.9735$
- Glass: $R^2 = 0.8507$
- Mineral - Not extractable: $R^2 = 0.9284$
- Mineral - Extractable: $R^2 = 0.8733$
Conclusions

• Coarse aggregates replacement is possible when taking legislation into account

• Highest porosity is present in extractable minerals (5.8%) and ceramics and stones (5.3%)

• With magnetic separation:
  – 70% of the mineral fraction is removable (32.5% overall)
  – A cleaner mineral stream of glass, ceramics and stones can be produced
  – The overall porosity of the remaining BA is reduced
Thank you for your attention!

- Questions, thoughts, ideas...