1. Introduction

- Brazilian ROM coal contains high levels of impurities (rock minerals and pyrite), hardly ever requiring concentration methods to reach current Brazilian power station’s standards.
- About 65% of Brazilian ROM coal are discharged as waste, generating AMD with the well known environmental impacts and economic costs.
- Coal tailings are the main environmental liability of the Brazilian coal-based industries.
- Important efforts have been carried out to treat the AMD and to recover degraded areas. We consider that part of the solution is to provide a useful destination to the coal tailings, considering the principles of sustainable development and zero waste mine.
2. AIM

- to characterize a typical coal tailing deposit located in southern Brazil, dividing it into three distinct fractions and suggesting the best applications for each one

3. Methods

- sampling
- samples preparation
- particle size analyses and densimetric studies
- analytical studies

**Power Station of South of Santa Catarina**

**USITESC**

- standards:
  - max 67% of ash
  - max 3.2% of sulfur

**Zero Waste Mine Approach**

- Source reduction → Cost-cutting

**Sampling**

- Particle size distribution
  - "+50.8 +2.0 mm" (coarse)
  - "+2.0 mm +0.1 mm" (fine)
  - "+0.1 mm" (slurry)
Organic liquids

The data from the separations were used to draw densimetric curves of the coarse and fine size fractions.

4. Results

Deposit Size Distribution

Analytical Results

<table>
<thead>
<tr>
<th>Relative density</th>
<th>Size (mm)</th>
<th>Sulfur (%)</th>
<th>Ash (%)</th>
<th>Mass (%)</th>
<th>XRD results*</th>
<th>Possible products</th>
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<tbody>
<tr>
<td>&lt; 0.1</td>
<td>1.8</td>
<td>87.7</td>
<td>52.8</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>+ 0.1 - 2.0</td>
<td>2.0</td>
<td>87.7</td>
<td>52.8</td>
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<td></td>
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</tr>
<tr>
<td>+ 2.0 - 5.0</td>
<td>3.3</td>
<td>60.5</td>
<td>6.8</td>
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<tr>
<td>+ 0.1 - 2.0</td>
<td>2.8</td>
<td>62.4</td>
<td>5.8</td>
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<td>3.1</td>
<td>87.8</td>
<td>19.0</td>
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</table>

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Scene using tailings in the new Power Station
(Ash: 67% e Sulfur: 3.2%)

**Sulfur rich tailing (> 2.8)**
- possibilities:
  - sulfuric acid
  - Coagulant
  - Ferrous sulphate
  - Pigments

Deposit recovering:
- Mass: 9.2%
- Pyrite: 65%

**Sulfur lean tailings (between 2.3 – 2.8)**
- R&D opportunities:
  - Construction
  - Ceramic
- Backfill
- Tailing (less environmentally aggressive)

<table>
<thead>
<tr>
<th>mass (ton)</th>
<th>sulfur (ton)</th>
<th>NAP (kg CaCO₃/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nowadays</td>
<td>11,000,000</td>
<td>638,000</td>
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<tr>
<td>With pyrite and energetic utilization</td>
<td>6,226,000</td>
<td>147,840</td>
</tr>
</tbody>
</table>

5. Conclusions
- The particle size analyses showed the following distribution by weight: 67% “coarse” particles (-50.8mm +2.0mm), 14% “fine” particles (-2.0mm +0.1mm) and 19% “slurry” (-0.1mm)
- Fine particles and coarse particles blended with the “slurry” could be used as energetic coal with 64.5% of ash and 2.9% of sulfur. Reaching a theoretical recovering by 34.2% of the whole deposit
- A concentrated of pyrite could be found in densities above 2.8, given a total theoretical recovery of 9.2%, with about 69% of pyrite
- The remaining material 56.6% (6,226,000 tonnes) are lower in pyrite and less aggressive to the environment. The total sulfur content of the deposit would decrease from 5.2% to 1.9% (60%)
- This approach brings a new outlook to tailings management in the Brazilian coal-based industries
- The study showed that it is possible to decrease or even eliminate the environmental liabilities of coal tailing deposits by means of research, development and innovation (R&D&I)

Acknowledgements