Characterization of a Coal Tailing Deposit for Zero Waste Mine in the Brazilian Coal Field of Santa Catarina

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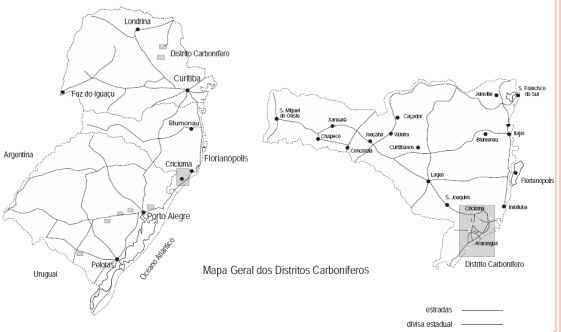
Contents

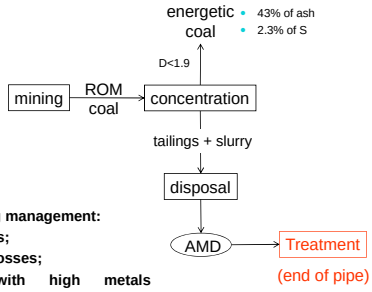
1. Introduction

- 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

Brazilian Coal Fields



Conventional Approach



Usual tailing management:

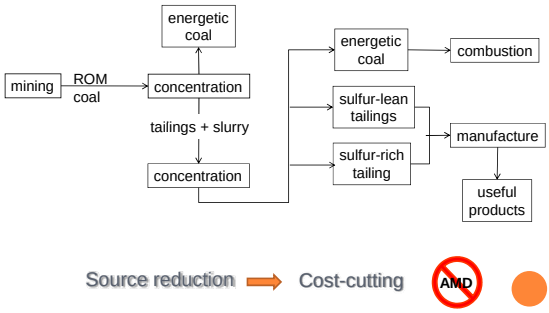
- **high costs;**
- **material losses;**
- **slurry with high metals contents;**

Typical Coal Tailing Deposit in Brazil

Power Station of South of Santa Catarina USITESC

- ✓ **standards :**
- max 67% of ash
- max 3.2% of S

Zero Waste Mine Approach



Source reduction ⇒ Cost-cutting AMD

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

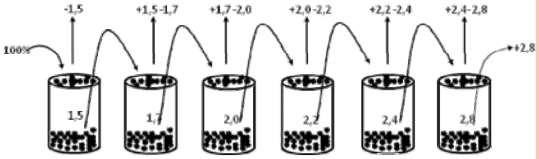
Sampling

Particle size distribution

- screening
  - “-50,8 +2,0 mm” (coarse)
  - “-2,0 mm +0,1 mm” (fine)
  - “- 0,1 mm” (slurry)

Heavy media separation

Organic liquids



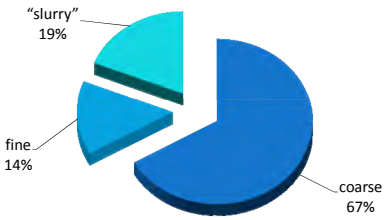
The data from the separations were used to draw densimetric curves of the coarse and fine size fractions

Material Analyses

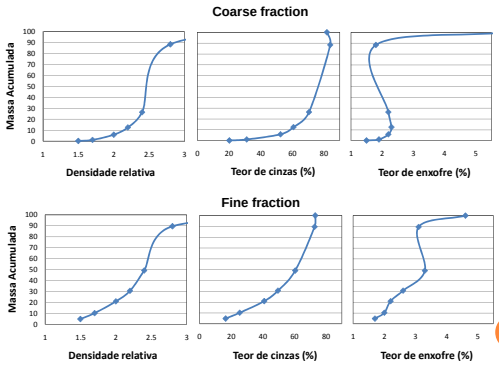
- Ash
- Total sulfur
- XRD
- Acid-base accounting tests

4. Results

Deposit Size Distribution



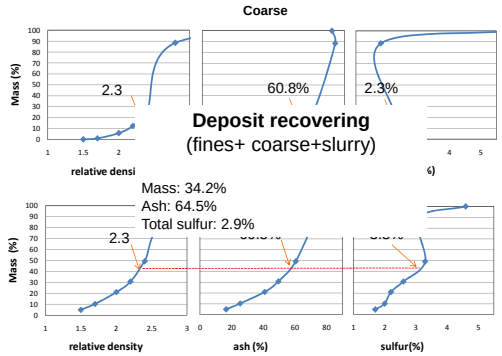
Densimetric curves



Analytical Results

relative density	size (mm)	sulphur (%)	ash (%)	mass (%)	XRD results*	possible products
- 2.3	+ 2.0 - 50.8	2.3	60.8	8.4	gypsum; kaolinite; quartz	energetic coal
	+ 0.1 - 2.0	3.3	60.5	6.8	gypsum; jarosite; quartz	
+ 2.3 – 2.8	+ 2.0 - 50.8	1.8	87.7	50.8	quartz; plagioclase	construction; ceramic; stonemeal; backfill
	+ 0.1 - 2.0	2.8	87.7	5.8	gypsum; quartz	
+ 2.8	+ 2.0 - 50.8	38.0	66.4	7.8	quartz; pyrite	sulphuric acid, ferric coagulant, ferrous sulphide, ferric oxide nonoparticles; inorganic pigments
	+ 0.1 - 2.0	17.8	76.2	1.4	quartz; pyrite	
N/D	- 0.1	3.1	67.6	19.0	gypsum; quartz	energetic coal

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



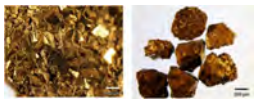
Sulfur rich tailing (> 2.8)

- possibilities:
  - sulfuric acid → Mature process
  - Coagulant
  - Ferrous sulphate
  - Pigments

  } New technologies

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)

	mass (ton)	sulfur (ton)	NAP (kg $CaCO_3$/ton)
Nowadays	**11.000.000**	**638.000**	**-162,5**
With pyrite and energetic utilization	**6.226.000**	**147.840**	**-62,5**

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 65% 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)

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