

PELLET FEED PRODUCTION FROM THE CONCENTRATION OF SAMARCO FLOTATION TAILINGS¹

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Abstract

Two samples were studied: "coarse tailing" (mechanical cell tailing) and "fine tailing" (composition of tailings from the tank cells and the columns flotation) aiming to produce a pellet feed with 1.0% of silica. These samples were subjected to tests of concentration, and the rougher stage was done in a pilot WHIMS, and the cleaner stage in a lab flotation cell and pilot column. With these tests were unable to obtain concentrates with 1.0% of silica and a high percentage of specular hematite (greater than 70%) in both samples, by combining magnetic concentration and column flotation. The global mass recovery was 8.5% and the global iron recovery was 57.5% in the "coarse tailing". For the sample "fine tailing" the mass recovery stood at 9.0% and the iron recovery at 42.5%.

Key words: Concentration of tailings.

PRODUÇÃO DE UM PELLET FEED A PARTIR DA CONCENTRAÇÃO DOS REJEITOS DE FLOTAÇÃO DA SAMARCO

Resumo

Foram estudadas duas amostras: "rejeito grosso" (rejeito da flotação mecânica) e "rejeito fino" (composição dos rejeitos das células de grande volume e das colunas de flotação) objetivando a produção de um pellet feed com 1,0% de sílica. Essas amostras foram submetidas a testes de concentração, sendo a etapa rougher realizada em um concentrador eletromagnético de carrossel em escala piloto, e etapa cleaner realizada em célula mecânica de laboratório e coluna piloto. Com esses testes foi possível obter concentrados com 1,0% de sílica e elevada participação de hematita especular (maior que 70%) em ambas as amostras, através da combinação concentração magnética e flotação em coluna piloto. A recuperação em peso global para a amostra "rejeito grosso" ficou em 8,5% e a recuperação de ferro global em 57,5%. Para a amostra "rejeito fino" a recuperação em peso global ficou em 9,0% e a recuperação de ferro em 42,5%.

Palavras-chave: Concentração de rejeitos.

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INTRODUCTION

Figure 1 shows a simplified flowsheet of Germano concentrator, where the tailings of the flotation process can be seen. The tailings from the mechanical cells is called "coarse tailing", and the tailings from the tank cells and columns are called "fine tailings".

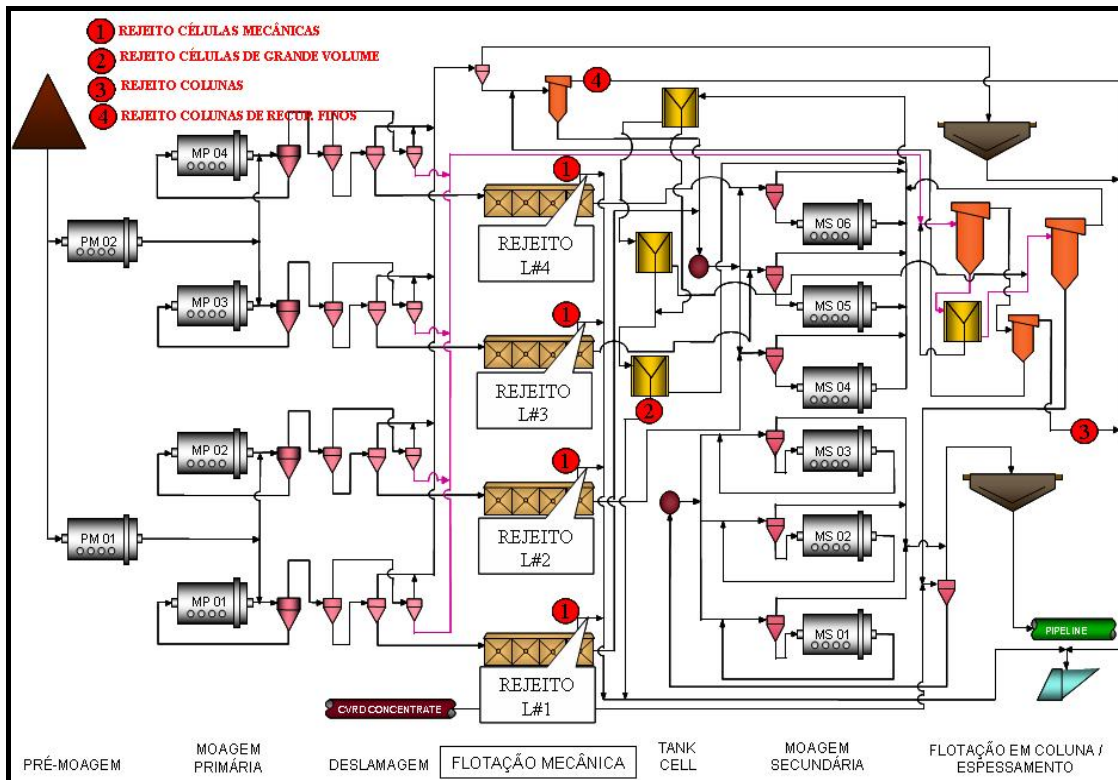


Figure 1 – Samarco Simplified concentrator flowsheet.

Santos⁽¹⁾ studied five different routes to produce a pellet feed using a representative tailing damn sample. The best route was the combination of classification in 37 μ m and concentration of -37 μ m in two stages (rougher and cleaner) using a Ferrous Wheel. After this previous work, Vieira⁽²⁾ studied the combination of WHIMS and flotation to concentrate the iron minerals presented in the Samarco flotation tailings. The purpose of this work is to produce a pellet feed with a maximum of 1.05% of silica using the combination WHIMS and flotation to concentrate the iron minerals presented in the Samarco flotation tailings.

MATERIAL AND METHODS

WHIMS Tests

The tests used a pilot WHIMS model WHC-05s from Inbrás-Eriez. The feed was 1.5 t/h with 30% of solids. Were tested matrices of 1.5 mm and 2.5 mm.

Flotation Lab Tests

Lab flotation tests were performed in WEMCO flotation cell of 2400ml, with rotation of 1300rpm. The depressant was corn starch from the Amafil and the collector was a mixture of EDA-3 monoamine Tomah 16-30 diamine.

Pilot Column Flotation Tests

The tests were performed in the Center for Technological Innovations (NUTEC) of the Fundação Gorceix. The columns dimensions were:

- Total height: 4.30m;
- Feed height: 2.80m;
- Diameter: 0.10m.

RESULTS AND DISCUSSION

“Coarse Tailing” Results

The operating conditions that enabled a pre-concentrate with higher iron content, with greater iron recovery were: ring rotation from 2.5rpm to 3.0rpm, magnetic field from 12500G to 14830G and 1.5mm matrix. Table 1 shows the compilation of results of 13 tests for pre-concentration of mechanical flotation tailings. The average in iron content of the pre-concentrate and the mass and iron recoveries were, respectively, 48%, 17% and 78%.

Table 1. Results of 13 concentration tests (minimum value – maximum value; average).

Sample	% solids	Fe (%)	SiO ₂ (%)	Mass Recovery (%)	Fe Recovery (%)
Feed	29.5 – 42.30 36,02	8,3 – 13,04 10,33	-	12.04 – 24.27 16.98	71.28 – 86.26 77.92
Concentrate	6.27 – 23.03 14.08	40,17 – 53,0 48.05	26.27 – 41.33 32.45		
Tailing	10.4 – 25.35 16.73	1.61 – 3.71 2.70	-		

Mineralogical analyses were conducted in some pre-concentrate, and demonstrated a high percentage of specular hematite and a quartz liberation degree of 90%, as shown in Figure 1.

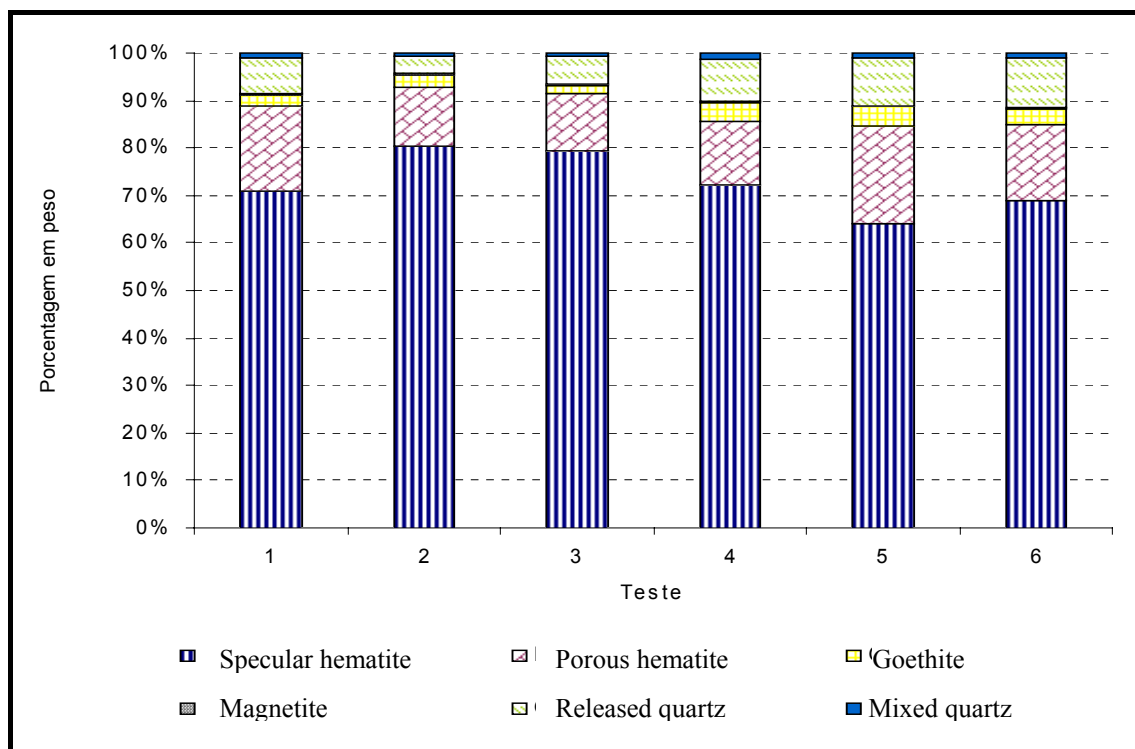


Figure 1. Mineralogical analyses of some pre-concentrates

It was possible to produce a final concentrate from the combination of magnetic concentration and column, as shown in Table 2.

Table 2 – Final concentrate production from the combination of magnetic concentration and column flotation

Teste	Pre concentrate		Column flotation				Overall Recovery	
	Fe (%)	SiO ₂ (%)	Fe tailing (%)	SiO ₂ conc (%)	Recovery		Mass (%)	Fe (%)
					Mass (%)	Fe (%)		
1	50.04	28.46	25.16	1.07	54.58	74.73	8.43	56.36
2			24.59	1.61	57.31	77.98	8.85	58.81

A 2.5 mm matrix was tested. This matrix increases the equipment capacity by 67%, with consequent iron recovery loss. The target was to reduce the number of WHIMS and thereby reduce the investment. The average content of iron in the pre-concentrate was 55.9%, but the mass and iron recoveries had a significant drop, 11.5% and 49.5% respectively. This matrix was then discarded. A final route was tested: magnetic concentration in two stages, rougher and cleaner, using both 1.5mm matrices. This route has also been discarded, since the average content of iron in the pre-concentrate was 44.0% (silica content of 38%), below the route that combines magnetic concentration and column flotation.

Concentration of the “Fine Tailings” Composition

The operational conditions that led to better results were identical to those used to reject the conventional flotation. The feed of the WHIMS was 15% of iron and the pre-concentrate was around 50% of iron and the mass and iron recoveries were 21% and 70% respectively. Using a combination magnetic concentration and flotation in column, it was possible to produce a concentrate with 0.98% silica, with global mass and iron recovery of 9.0% and 42.5% respectively.

CONCLUSION

By combining magnetic concentration (WHIMS) and column flotation, it was possible to produce a pellet feed with 1.0% of silica and with a high percentage of specular hematite (greater than 70%). The overall mass and iron recovery to the sample "coarse tailing" was 8.5% and 57.5% respectively. This represents a possible pellet feed increase of 566.000t/y. For the sample "fine tailing" the mass and iron recovery stood at 9.0% and 42,5%, respectively. This represents a possible pellet feed increase of 202.225t/y. More tests of tailings concentration will be done, since the iron levels in these tailings has been dropped because several implemented improvements in the concentrator of Germano.

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