MILLING OF THE PHOSPHATE ROCK FLOTATION CIRCUIT CIRCULATING LOAD AIMING PRODUCTION INCREASE AND IRON CONTENT REDUCTION IN THE FINAL CONCENTRATE

Michelle Fernanda de Lira Teixeira, Copebras/CMOC, Catalão-Brazil
michelle.teixeira@cmocbrasil.com
Anastácio Honório de Melo Filho, Copebras/CMOC, Catalão-Brazil

André Carlos Silva, Federal University of Goiás, Mine Engineering Department, Capes scholarship POS-DOC - 88881.119296/2016-01, Catalão-Brazil, ancarsil@ufg.br

Thiago Drumond de Alvarenga de Araújo, Copebras/CMOC, Catalão-Brazil
Maurício José de Oliveira Júnior, Copebras/CMOC, Catalão-Brazil
Wanderson Ferreira Borges Júnior, Copebras/CMOC, Catalão-Brazil
Bruno Palhares Milanzi, Copebras/CMOC, Catalão-Brazil
Jailson Pinto Cardoso, Copebras/CMOC, Catalão-Brazil

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Phosphorus has its main application in the production of phosphoric acid, being the apatite series its main ore. The Brazilian main phosphorus reserves are igneous, as is the case of Catalão alkaline dome, were Copebras/CMOC International has operations. The content of P\textsubscript{2}O\textsubscript{5} in the ROM has been reduced over the years and, as a consequence, the content of the contaminants in the concentrate, produced by flotation, which enhances the difficulty in the phosphoric acid production. Only traces of arsenic, iron, and heavy metals can be present in high-purity phosphoric acid. The circulating load of the Copebras’ phosphate rock flotation circuit was submitted to bench scale flotation tests with addition of a milling step were carried out in order to increase the recovery of P\textsubscript{2}O\textsubscript{5} and the reduction of the Fe\textsubscript{2}O\textsubscript{3} content to values below 5%. Samples were collected from the flow composed by the scavenger concentrate and cleaner tail, with d\textsubscript{95} <208 μm and average content of 26.2% of P\textsubscript{2}O\textsubscript{5} and 13% of Fe\textsubscript{2}O\textsubscript{3} (6% hematite, 5% goethite, 1% magnetite, and 1% ilmenite) and comminuted in a pilot pant rod mill. Three samples with different d\textsubscript{95} (<150, <105, and <74 μm) were produced. Exploratory flotation tests were performed to optimize collector and depressant dosages. The best results were obtained for dosages of 500 g/t of depressant and 20 g/t of surfactant. For the collector dosage the best results were obtained for 235 g/t (d\textsubscript{95} <150 μm), 220 g/t (d\textsubscript{95} <105 μm) and 200 g/t (d\textsubscript{95} <74 μm). The results indicated that the milling of the flotation circulating load increased the mass recovery (from 27.3% to 37.5%) and metallurgical recovery (from 45.8 to 62.9%) of phosphate rock, as well as a reduction from 2.32 to 2.04% of Fe\textsubscript{2}O\textsubscript{3} content (for the sample with d\textsubscript{95} <150 μm). The industrial implementation of a milling stage of the flotation circulation load and a subsequent flotation of this material has the potential to increase the overall process efficiency by approximately 5.5%, resulting in a production increase of 62,000 tons/year of phosphate rock concentrate, with higher quality than the one currently produced. The phosphate rock flotation tailings feeds a niobium processing plant, a co-product of extreme importance due to its economic value. The proposed circuit increased the niobium liberation degree and its content in the produced tailings, which will probably lead to a higher recovery of the same.