A COMPARTIVE STUDY OF DIFFERENT COLUMNS SIZES FOR ULTRAFINE APATITE FLOTATION

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The Brazilian phosphate industry has a long-term tradition in beneficiation of weathering igneous phosphate ores. The typical flowsheet applied involves grinding; classification in coarse and fines fractions; magnetic separation (low and high intensity); desliming to remove particles < 10 µm; barite flotation and apatite flotation. Desliming operation to discharge the ultrafine particles less than 20 µm prior to concentration by flotation is a common practice on the phosphate ores beneficiations plants, including those that treats sedimentary and igneous ores. Guimarães and Peres (2002, 2003) resume the Brazilian industrial experience in beneficiation of the material with particle size < 44 µm. The first industrial application was in Araxá concentrator in the beginning of 80´s in a circuit consisting of desliming in 40 mm hydrocyclones and apatite flotation in column machines. Corn starch and fatty acids being utilized as reagents. The concept of this process was expanded to other Brazilian plants located in Catalão (Goias state), Tapira (Minas Gerais state) and Cajati (São Paulo state) are still in the 90´s. It is estimated that the apatite concentrate from slimes represents 11% to 13% of the overall production. Matiolo et al (2017) showed results of a flowsheet developed to apatite concentration from a slime sample provided by the industrial phosphate ore plant of the Copebras (China Molybdenum – CMOC International), located at Catalão (Goias state, Brazil). The flowsheet involves desliming in hydrocyclones (40 mm) in two stages, followed by apatite flotation in columns.The authors compare the flotation results obtained in a rougher flotation in a 3” diameter column flotation (2.0 m in height) in comparison with the results obtained in a circuit with rougher/cleaner configuration applying a 4” diameter column flotation (6.0 m in height) to rougher and a 2” diameter column flotation (6.0 in height) to cleaner. This work shows flotation results considering a circuit with rougher/cleaner configuration with different sizes column flotation, as follow: Circuit 1 (rougher – 4” diameter column flotation; cleaner – 2” diameter column flotation), and circuit 2 (rougher – 6” diameter column flotation; cleaner 4” column flotation). The solids feed rate in each circuit was 35 kg/h and 46 kg/h dry basis respectively. The rougher flotation results show that 6” diameter column flotation achieved higher apatite recovery when compare with the results obtained in the 4” diameter column flotation, for similar P_2O_5 grades. By the other hand, the results obtained in cleaner flotation are very similar in both columns (4” and 2” diameter column flotation). The best results obtained in the 6” diameter column flotation can be explained by the fact that in this column, the bubble generation system is a cavitation tube and the system applied in the 4” diameter column flotation is a porous tube. The bubble size distribution obtained on the cavitation tube is in general smaller than the obtained on the porous tubes. Fine bubbles improved the collision efficiency between bubbles and particles which leads to higher recoveries, in special for ultrafine particles flotation.

Guimarães, R.C., Peres, A.E.C. Production of phosphate concentrates from slimes: Brazilian experience. In: Proceedings XXII International Mineral Processing Congress, Cape-Town, South Africa, pp 606-612, 2003.

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