

Flotation of High Grade Iron Sample of Esfordi Phosphate Ore in Order to Increase Phosphate Grade and Recovery

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ABSTRACT

In order to processing the Esfordi phosphate ore, a sample was prepared from rocks contains high amount of Apatite and Quartz and iron minerals such as magnetite and Hematite These rocks contain 50% to 60% Fe₂O₃ and 5% to 20% P₂O₅. Regarding researches that have been done before, flotation was chosen as the best process for treating this sample. First, optimum levels of variations were determined by some experiment and then a test was conducted in the optimum conditions. The sample was ground for 12 minutes and desliming was performed in pressure of .5 Kg/cm². Optimum conditions were determined to reach maximum recovery and grade of phosphate and minimum recovery and grade of iron. 300 g/t of Flo-ys20 was chosen as collector and frother, 40 g/t of Lina-Z80 was used as collector and frother, 400 g/t starch was used as depressant and optimum pH determined to be 9.5. In these conditions, phosphate was floated and two stages of cleaning have been done on the product. Final phosphate product contained 34.4% P₂O₅ and 2.8 Fe₂O₃, recovery of flotation was 94% and total recovery of the process was 83%.

Keywords: Flotation, Phosphate, Mineral processing.

INTRODUCTION

Flotation as a streamlined process plays unique and important role in treating metallic ores and industrial minerals. Various factors have effects on flotation process which can be divided in several categories. In the first category, factors depend on physicochemical properties of minerals in the ore. Second group of parameters depends on flotation conditions and method such as direct flotation, reverse flotation and etc. Third group of factors depends on amount and properties of various reagents which are used in process of selective flotation such as collectors, depressants, modifiers and etc. last group of factors depend on kinetic of reaction, conditioning time and etc.

Phosphate Flotation

Phosphorous is one of the most important vital elements in the nature which is mined and processed from industrial mineral of Apatite. Apatite minerals are found in nature in two forms of sedimentary and igneous. Near 85% of industrial consuming phosphate provided from sedimentary phosphates. Sedimentary rocks which contain phosphorus divided in two groups of phosphorite and phosphate minerals. Most important phosphate minerals in sedimentary rocks are Carbonate-Flour-Apatite, Chloro-Apatite, Hydroxyl-Apatite and Flour-Apatite. Phosphorites contain Pellets and Guanos (near 2% of explored deposits in globe). Igneous phosphate rocks especially alkaline igneous rocks and carbonatites are reach in Apatite. These

deposits contain 5% to 35% P₂O₅. There are considerable amount of rare elements in Flour-Apatite. Esfordi phosphate ore is igneous.

Regarding that librating size of phosphate minerals in their ores is usually less than 150 microns, commonest process for these minerals is flotation. Apatite flotation is in the category of low solubility salts flotation. These salts have low solubility in aqueous solutions and their surface decomposition in aqueous environments produces various ions that would make their physicochemical behavior complicated and the process to be nonselective. Absorption density, surface hydrophobicity and flotation recovery increase from Flour-Apatite to Carbonate-Apatite, Hydroxyl Apatite and Chloro-Apatite.

It's proved that in all cases Oleates adsorb with chemical mechanism on Apatite surface as the best collector of flotation in presence of Alkyl succinates and Alkyl sulfunates and produce calcium Oleate. In term of collector effect mechanism, in flotation of oxide and silicate minerals, absorption of tall oils (anionic collector) is a paragon for chemical absorption on the surface of mineral and absorption of alkyl sulfunates (anionic collector) and Amines (cationic collector) are instances of physical absorption on minerals.

Mineral Processing Plant of Esfordi Phosphate

In mineral processing plant of Esfordi phosphate after mining, the ore is transported to crushers by trucks. Transported materials with maximum size of 60 mm passes grizzlies feed