

Flotation of Rare Earth Oxides from Iron-Oxide Silicate Rich Tailings Using Fatty Acids

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Abstract : The versatility of froth flotation has made it vital in the beneficiation of rare earth elements minerals from either high or low-grade ores. There has been a significant increase in the quantity of iron oxide silicate-rich tailings generated from the extraction of primary commodities such as copper and gold in Australia, which have been identified to contain very low-grade rare earth oxides ($\leq 1\%$). There is a vast knowledge gap in the beneficiation of rare earth oxides from such tailings. The aim of this research is to investigate the feasibility of using fatty acids as collectors for the flotation recovery and upgrade of rare earth oxides from selected iron-oxide silicate-rich tailings. Two forms of fatty acid collectors (oleic acid and sodium oleate) were tested in this investigation. Flotation tests were carried out using a 1.2 L Denver D-12 cell. The effects of pulp pH, fatty acid dosage, particle size distribution (-150 +75 μm , -75 +38 μm and -38 μm) and conventional depressants (sodium silicate and starch) dosage on flotation recovery of rare earth oxides were investigated. A comparison of the flotation results indicated that sodium oleate was the more efficient fatty acid for rare earth oxides flotation at all the pulp pH investigated. The flotation performance was found to be particle size-dependent. Both sodium silicate and starch were unselective in decreasing the recovery of iron oxides and silicate minerals, respectively with the corresponding decrease in rare earth oxides recovery. Generally, iron oxides and silicate minerals formed the substantial fraction of the flotation concentrates obtained, both in the absence and presence of depressants, resulting in a generally low rare earth oxides upgrade, even though rare earth oxides recoveries were high. The flotation tests carried out on the tailings sample suggest the feasibility of rare earth oxides recovery using fatty acids, although particle size distribution and minerals liberation are key limiting factors in achieving selective rare earth oxides upgrade.

Keywords : depressants, flotation, oleic acid, sodium oleate

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