

Extraction and Flotation Performance Evaluation of Bio-collector in High Ash Graphite Ore Beneficiation

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ABSTRACT

The rapid depletion of high-grade ores and natural resources, utilization of low-grade ores by beneficiation becomes utmost importance for sustainable development and resource management. The increasing wide range of applications of graphite for electrode, lubricants, refractory applications especially the recent surging electric automobile industry, resulting in significant need of graphite in future. Graphite demand in the energy storage industry is expected to grow faster than today's demand in future. Most of the graphite ore deposits in India are of low grade containing high ash content. Graphite is a naturally hydrophobic mineral and froth flotation process involves separation of minerals based on its surface hydrophobicity. The chemical reagents commonly used in graphite flotation are hydrocarbon oils such as diesel, kerosene along with a frothing agent such as methyl isobutyl carbinol (MIBC) which are non-environment friendly, hazardous and not cost effective while used at large scale industrial processing of the ore. Hence, in this work, a new eco-friendly bio-collector was developed from the exocarp or rind of a shrubaceous plant as an alternate flotation reagent for graphite. The flotation performance efficacy of this bio-collector was evaluated in comparison to the existing practice of diesel-MIBC dual reagent system in graphite flotation. A high ash low-grade graphite ore from eastern India with 84.71% ash and 9.07% fixed carbon was beneficiated by flotation technique for recovering graphite with lower ash content. The ore characterization studies mineralogy (XRD, ore microscopy) and morphology (SEM) reveal that the graphite mineral phase with sheet like appearance was accompanied predominantly by quartz, with minor fractions of biotite, muscovite and kaolinite. The spectral analysis of the developed bio-collector was characterized (FTIR). Under similar flotation test conditions on processing the high ash graphite ore, a final concentrate graphite product with 11.40% ash using diesel & MIBC as flotation reagents and 11.74% ash using bio-collector was obtained which indicates that the developed bio-collector could be a potential replacement for diesel-MIBC reagents being used in graphite processing mineral industries. Also, this bio-collector has an added advantage of being a natural plant-based extract with environmental compatibility leading to a step towards clean ore processing.

Keywords: Low grade graphite ore; High ash graphite; Froth flotation; Diesel; Exocarp; Bio-collector

