Development Optimisation of Prototype Froth Floatation facility as an advanced physical beneficiation technique to upgrade low grade Sri Lankan vein graphite in Kahatagaha Graphite Lanka Limited

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Presently, Sri Lanka is the sole Vein Graphite (VG) supplier to the world market. Since the best quality VG has been selected in the sorting procedure, low-quality VG remains while leaving a chance for upgrading. The natural hydrophobicity of graphite has been utilized by the Froth Floatation (FF) which is a physical beneficiation technique uses to separate graphite from gangue minerals. Few studies have been conducted for both flake graphite and VG. Therefore, the present study was forced to set up a prototype FF facility to optimize its cell design and identify the pulp density, frother type, and dosage, collector dosage for the economically feasible installation of the FF plant at KGLL. The cylindrical cell was designed with a height of 20 cm and diameter 12 cm. 150 g of ≤ 72 µm VG powder was mixed with different volumes of water to find optimum solid to liquid (S/L) ratio. The effect of the collector and the frothers were determined by varying the kerosene dosage for 0.01g to 0.10g and both Pine Oil (PO) and 4-Methyl-2-pentanol (TMTP) for 0.01g to 0.05g, respectively, while all other factors were kept constant. Resulted floated VG samples were analysed by Carbon Content (CC) (ASTM-C561) and X-ray Florescence (XRF) analyses. The optimum recovery of 80% of VG was achieved with the pulp density of 10% S/L ratio and further, 0.08g of kerosene, 0.02g of TMTP, and 0.04 g of pine oil. Among the two frothers, TMTP was cost-effective and easy to handle than pine oil. The CC of the obtained floated VG graphite has upgraded from 90.2% to 96.58% and comprehensive elemental analysis was confirmed the removal of iron, silica, and other metallic impurities up to 72%. Therefore, the FF plant can be effectively run with the 10% of S/L ratio together with kerosene collector and TMTP frother.

Keywords: Vein graphite, Froth-flotation, Surface science, Value addition