Flotation Studies on Optimization of Carbon Recovery from Steel Plant Sludge

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ABSTRACT

Mining and mineral-based processing plant tailings and sludge from processing plants contain solids in water which can contaminate soil and water supplies resulting in environmental damage. However, these solids suspended in water (sludge) still contain valuable minerals which can be recovered for primary and secondary usage. Feed material goes through multiple processing stages in a processing plant. Thus, sludge contains gangue particles associated with valuable carbon values in a complex manner. In this study, flotation method has been studied as a method for carbon recovery from processing plant sludge residue. The objective is to recover maximum carbon value from the sludge and optimize the flotation process. Carbon and iron values in the sludge residue was found to be in the range of 18-26% and 35-38% respectively. Preliminary flotation studies were carried out using a number of collectors i.e., diesel oil, kerosene Oil and other synthesized reagents such as FBD, PBD etc. Methyl isobutyl carbinol (MIBC) was used as frother. Based on the results, operational conditions were selected for further experimentation. Response surface methodology (Box-Behnken design) approach of designing and optimization was selected for this purpose. Effects of input parameters i.e., collector dosage, frother dosage and rpm have been studied using advanced statistical method. ANOVA has been applied to determine the order of significance of input variables for different outputs of this investigation. Empirical models based on regression analysis were developed to establish relationship between optimum recovery and grade of carbon concentrate and input parameters. Optimized carbon recovery of 54.79% was obtained at cell rpm of 1200, frother dosage of 48 gpt and collector dosage of 430 gpt. The recovered carbon can be further used to supplement the carbon requirement for iron making.

Keywords: Froth flotation; Processing plant sludge; Box-Behnken design; ANOVA; MIBC; Empirical model.

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