

ABSTRACT

Liquid-solid fluidized bed separators are one of the important types of equipment for the beneficiation of low-grade ore. Experiments were carried out for understanding the separation of coal in the allflux separator. More importantly, the study provides an insight into the presence of particle misplacement during separation of particles. Two new indexes “*misplacement index*” and “*normalized misplacement index*” were proposed in the present study for quantification of the degree of particle misplacement and segregation performance in liquid-solid fluidized bed. The present study emphasizes into the qualitative and quantitative evaluation of the misplacement of particles inside a fluidized bed separator. Binary mixtures of iron ore, and quartz were used to study the misplacement of particle. The present investigation also aims at understanding the effect of vertical baffle along with parameters such as superficial velocity, overflow height, feed composition and Mean Particle Size Ratio (MPSR) on the particle misplacement and segregation in a liquid-solid fluidized bed separator. Further, the study explores to understand the effect of the different cross-sectional shape of columns on the hydrodynamics, separation, and misplacement of particles in liquid-solid fluidization. A predictive model for above two indexes were also developed using artificial neural network. The model is having three-layer architecture (i.e. MLP 7-4-2). It is found that MPSR, particle sizes, static bed height, iron ore concentration in the feed, overflow height and superficial velocity have a significant effect on the misplacement of the particles. Further, there exists a critical feed composition where the misplacement is low. In addition to this, there also exists a critical MPSR where the fluidized bed operates in a completely mixed state and the point could be considered as the starting of the layer inversion. It was found that the fin type vertical baffles have negligible or no effect on the particle misplacement. The results indicate that there is a critical length to width ratio of column, beyond which substantial reduction in particle misplacement is possible. The particle misplacement is low for rectangular shape columns compared to the square and circular shapes.

Keywords: Liquid-solid fluidization; misplacement index; normalized misplacement index; degree of misplacement; segregation; ANN.
