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Elutriation Behavior of Fine Particles fed with Coarse Particles during Fluidization

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Abstract

Fluidization of group C particles (smaller than a few tens of microns) in Geldart classification is difficult owing to their strong adhesive and cohesive properties. Powder Particle Fluidized Bed (PPFB) is a technique to fluidize these fine particles with coarse particles, recovering only the fines based on the difference in terminal velocities [1]. Reliable empirical equations for the elutriation rate constants of group C particles, K_i, were available in the literature [2,3], but the equations were proposed for a closed system with fixed amounts of coarse particles. As compared to a standard PPFB into which only fine particles are fed continuously, we made solid mixtures of coarse and find particles at a certain ratio, and fed the solid mixture at a certain rate into a bed of the mixture during fluidization. In this study, comparisons of K_i were made between the values obtained experimentally and estimated empirically by using the equations [2,3]. Moreover, an additional study was done to see if the applicable range of equations could be extended for higher density of fines.

The results clarified that, while estimated K_i values (with fixed amount of coarse particles) were constant irrespective of particles feeding rate, the experimentally obtained K_i values in this study (co-feeding of coarse and fine particles with fines mixture ratio of 0.1) using high density fines such as iron ore were always higher by one order of magnitude than the estimated ones with a slight dependence on particles feeding rate (Figure 1). Further study is needed to explain this different tendency.

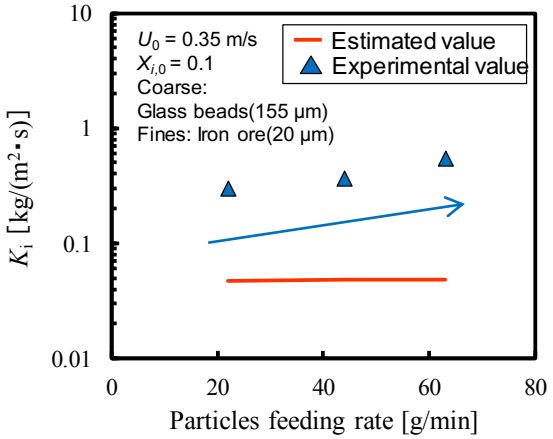

Figure 1. Comparison between experimental and estimated values for the dependence of K_i on particles feeding rate for particles mixtures of glass beads (155 μm) and iron ore (20 μm).

References

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