Separation Features of Fine Particle Processing in a Crossflow Separator

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A Cross Flow Separator works on the principle of hindered settling and liquid fluidization to accomplish gravity concentration of fine particulate mass. Heavier particles penetrate the fluidized suspension to settle at the bottom to be discharged as the underflow while the lighter particles remain at the top and are carried away by the upward flowing water to the overflow outlet. Influence of bed depth, feed rate and teeter water flow rate on the separation features along with the response of feed particle size was investigated with reference to a difficult fine coal (1.4 x 0.1 mm) having 33% ash. Characterization of the feed was followed by a detailed experimental program using response surface methodology. Products of each experiment were characterized to understand the separation mechanism and how various particles respond to the process conditions. The process responses were estimated in terms of mass yield, ash levels of both products and combustible recovery. The experimental data were analyzed to arrive at statistically significant correlations for the response variables. The process was optimized and under optimum conditions, clean coal with 24% ash at 63% mass yield and over 70% combustible recovery was obtained. Overall Ep was 0.34 with an effective separation density of 1.81 g/cc. It was concluded that a ratio of 10:1 between the top and the bottom sizes of the particles may be acceptable in the feed material. The importance of the flow behavior was discussed. The process features were also described phenomenologically vis-à-vis the experimental observations.