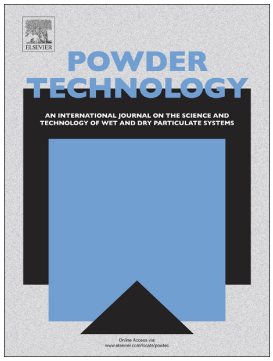

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Experimental Analysis of Particle Velocity and Acceleration in Vertical Dilute Phase Pneumatic Conveying

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ABSTRACT

Many parameters need to be investigated in order to reduce power consumption, product degradation and flawless operation of pneumatic conveying systems. Particle velocity in vertical conveying is one such parameter that we are focussing on in this study. Many correlations were developed to predict particle velocity in steady state zone. Still, they lacked in consistency for finding any correlation that would explain particle velocity in acceleration zone as well as in fully developed flow. In this study, an experimental system was developed with 5 m vertical test section having 50 mm ID of pipe. Materials selected were representing a large range of Archimedes number (10^2-10^7). Very small quantities (Diluted) of various materials were manually fed into the upward conveying airflow using a piston forced particle feeder. Particle velocities were measured in acceleration as well as in fully developed region. Visuals of particle flow were recorded using high-speed camera and analysed by a Matlab programme, specially developed for this analysis. Terminal velocity analysis ($u_{p\text{-}ss}=u_a-u_T$) has been used to predict steady state velocity. Terminal velocity analysis was found to have good agreement with previously published data by using its (terminal velocity) true value. Correlation of particle velocity and acceleration length was developed based on the investigation of statistical velocity distribution at different locations in vertical test section. The developed parameters of vertical conveying in this study have been compared with horizontal conveying results of Santo et al. [1].