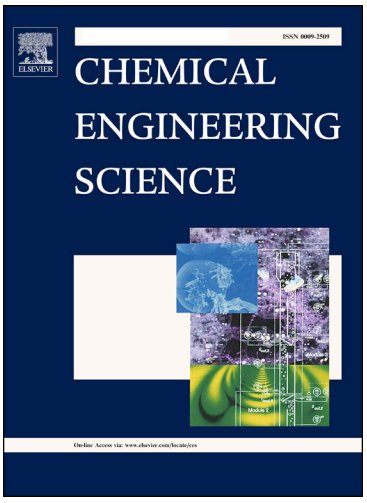

Experimental study on particle steady state velocity distribution in horizontal dilute phase pneumatic conveying

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EXPERIMENTAL STUDY ON PARTICLE STEADY STATE VELOCITY DISTRIBUTION IN HORIZONTAL DILUTE PHASE PNEUMATIC CONVEYING

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ABSRACT- *Particle and slip velocity evaluations are essential for the design of dilute phase pneumatic conveying systems in which the particles are fully suspended in the pipe, transportet at high velocities and low pressures with solid loading ratios that do not exceed 15. Although the subject was widely researched, it lacks a consistent correlation over various operating conditions and wide range of particle properties. Moreover, investigating the three dimensional velocity distribution in a cross section of a pipe may further contribute to the understanding of the phenomenon. In this study, we present a thorough experimental investigation of particle velocity obtained from 3",2" and 1" dilute phase pneumatic conveying systems with various operating conditions and conveyed material with the following property ranges:* $0.06mm < d_p < 4mm;\ 940\frac{kg}{m^3} < \rho_p < 5800\frac{kg}{m^3};\ 14\frac{m}{s} < U_g < 28\frac{m}{s};\ 2.4\cdot 10^4 < Re_g < 1.4\cdot 10^5;\ 26mm < D < 76mm;\ 0.3 < \eta < 3.$ *The velocity was obtained using a high speed video camera combined with image processing. Data was obtained in all three dimensions for each particle allowing an investigation of the velocity distribution and the effect each component has on the equivalent velocity. The velocities of the non-axial directions were found to be considerably low in relative to the axial velocity. Therefore, in terms of the kinetic energy (e.g.), the non-axial velocities have negligible contribution; however, they have a major effect on the flow and acceleration mechanism. A correlation is presented for the axial particle velocity evaluation in the range of the tested operating conditions, which is mainly affected by the Archimedes number of the particle, with a good fit of our data and various data points from previous publications.*

KEY WORDS: pneumatic conveying, particle velocity, slip velocity.

1. INTRODUCTION