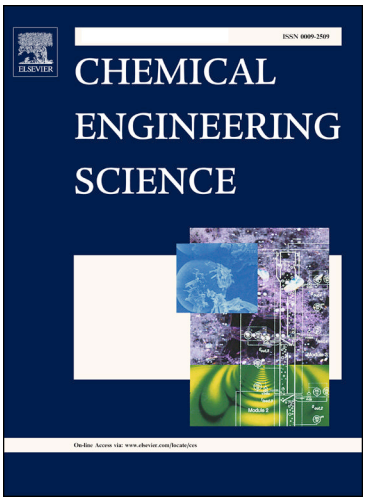

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Hydrodynamic characteristics of particles with different roughness and deformability in a liquid fluidized bed

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ABSTRACT

The effects of particle roughness and deformability on the fluid dynamics of liquid fluidized beds were investigated using a 190.5-mm-diameter column and particles with different surface finish and stiffness. Glass beads and plastic "BBs" coated using different techniques were employed as the rigid particles, while cooked starch pearls (tapioca) and sodium alginate gel beads produced from different gelling solutions served as the deformable particles. The particles were characterized by measuring their densities, diameters, Young's moduli and coefficients of restitution. Terminal settling velocities were also measured by the free-falling method, and the bed voidages over a wide range of fluid flow rates were estimated from pressure drop measurements along the column height. Correlations for rigid smooth spheres underestimated the single-particle terminal settling velocity for particles with many asperities, especially for the soft spheres. The Richardson-Zaki equation, derived empirically for rigid particles, provided a satisfactory description of the liquid fluidized bed expansion, especially for rigid particles. Although the voidage deviations observed for the soft particles were less than 10%, the fluidization behavior of these particles was affected much more by the particle Stokes number than for rigid spheres. Though there is evidence in the literature that particle surface roughness is responsible for