Hydrodynamic Characteristics in a Binary Solid-Liquid Fluidization System

Sudipta Let*, Sourav Habib Halder , Ranjan Kumar Basu and Sudip Kumar Das

Department of Chemical Engineering, University of Calcutta, Kolkata, India
*Corresponding author, E-mail: slchemengg_rs@caluniv.ac.in

Abstract

In fluidization, the process occurs when a fluid (liquid or gas) is passed up through the solid material. Fluidized beds are used in many industrial processes due to their large contact area between phases, which enhances chemical reactions and transport processes. The hydrodynamics parameters in a fluidized bed are the minimum fluidization velocity, bed expansionsion characteristics and minimum elutriation velocity. The study of these parameters are extensively reported in literature for uniform solid-liquid system. However, the same for the study on the binary solid-liquid fluidized bed are meager. This paper deals with the experimental investigation of the fluidization behavior in binary solid-liquid fluidized beds of non-spherical particles as solid phase and water as the liquid phase. Different average particle sizes from $3.057x10^{-3}$ m. to $7.74x10^{-3}$ m were used to prepare binary mixture in different weight ratios of 0%, 20%, 40%, 60%, 80% and 100% in a perpex column for fluidization. The pressure drops across fluidized bed and the porosity were measured at different liquid velocities. These data were analyzed to determine the minimum fluidization velocity (U_{mf}) for binary solid–liquid in fluidized bed by graphical method. The value of minimum fluidization velocity is practically the same for these two methods. The minimum fluidization velocity (U_{mf}) increases with the increase in particle size and decrease with the particle spericity in binary solid-liquid fluidized bed. The porosity decreases with an increase in particle size with a particular liquid flow rate at fully fluidized condition.The experimental values were compared with the correlations available in literature. Different empirical correlations have been developed with statistical accuracy.

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