NOVEL METHOD TO MEASURE FINE PARTICLE CIRCULATION RATES IN DRAFT TUBE CONICAL SPOUTED BEDS

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The spouted bed regime is an alternative contact method to fixed and fluidized beds. The ratio between the inlet diameter and particle diameter limits the scaling-up of spouted beds (the inlet diameter should be smaller than 20-30 times the particle diameter). The insertion of a draft tube is the way of overcoming this limitation.

Particle cycle time is defined as the time the particle takes to travel from the top of the annulus downwards and back again to its starting point. Since the proportion of time spent by a particle in the spout is insignificant compared with that spent in the annulus, particle cycle times can be deduced from solid flow patterns in the annulus (1).

Knowledge of particle cycle time is very useful to ascertain the bases of the spouted bed technique. Furthermore, information on this parameter and particle trajectories is essential for spouted bed applications, given that the average cycle time regulates energy and mass transfer, and influences chemical reactions (2).

The most used technique to measure the solid cycle times is particle tracking, but monitoring of fine particles requires very sophisticated techniques, whose reliability is open to debate. Accordingly, the main aim of this work is to setup a device and develop a methodology for measuring the circulation rate of fine particles in conical spouted beds.

The device is a sector located on the upper surface of the annulus, which collects the particles raining down in the fountain. Based on the information gathered, the factors of major influence on the solid circulation rate are determined and their effect is quantified. The material used for operation is building sand of 0.6 mm particle diameter, but glass beads (coarse particles) of 4 mm diameter have also been used so as to verify the methodology proposed by comparing the results with those obtained by monitoring a marked (painted) particle.

REFERENCES