Chapter
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TESTING OF NEW DESIGN OF MESH-COUPLED AXIAL BLADE DISTRIBUTOR FOR SWIRLING FLUIDIZATION OPERATION

Muhammad Yasin NAZ[1]
Shazia SHUKRULLAH[2]
Shaharin Anwar SULAIMAN[3]
Afşin GÜNGÖR[4]

Introduction

Fluidization is a technique in which solid particles in a bed are transformed from a static solid-like state to a dynamic fluid-like state and the bed behaves like a liquid [(1)]. When the fluid flows through the bed, it applies a force on the particles, which is referred to as the drag force. As the rate of vertically upward flow increases, the drag force exerted on the particles also increases and at an instant it becomes large enough to unlock the arrangement of the particles. The FB's designs have many types, as developed by the researchers in the past[(2, 4)]. They include: circulating fluidized bed, centrifugal fluidized bed, tapered fluidized bed, vibro-fluidized bed, spouted fluidized bed[(5)]. These beds have been in use for past several decades. They have been applied in drying, combustion, gasification of biomass, surface treatment, heat and catalytic cracking, mass transfer, surface coating[(6, 7)]. But these conventional designs of fluidized beds beside of their many advantages, also have many shortcomings which affect their performance, like: they have moving parts, high pressure drop, complex hydrodynamics, inefficient particle mixing and limitation of using for variety of particle sizes etc. None of the design can be considered as optimized even for a single chemical or mechanical processes because of above discussed shortcomings. These shortcomings affect the quality of fluidization, yield of the process, energy consumption etc. The conventional fluidized beds also have limit on the size of the solid particles to be

[1] University of Agriculture, Faisalabad, Pakistan, yasin603@yahoo.com.
[2] University of Agriculture, Faisalabad, Pakistan, zshukrullah@uaf.edu.pk.
[3] Universiti Teknologi PETRONAS, Malaysia, shaharin@utp.edu.my.
[4] Akdeniz University, Turkey, afsingungor@hotmail.com.

found decreasing over bed height. For all the bed heights, the particle velocity at the top of the bed was found lower than the side of the bed. This different becomes more significant for larger bed heights showing that the bed might be composed of multi-layers.

Keywords: Swirling fluidized bed, mesh-type distributor, particle image velocimetry, hydrodynamics of particles.

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