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Computational Fluid Dynamics (CFD) Simulation Approach for Developing New Powder Dispensing Device

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Abstract : Manually dispensing solids and powders can be difficult as it requires gradually pour and check the amount on the scale to be dispensed. Current systems are manual and non-continuous in nature and are user-dependent and difficult to control powder dispensation. Recurrent dosing of powdered medicines in precise amounts quickly and accurately has been an all-time challenge. Various new powder dispensing mechanisms are being designed to overcome these challenges. A battery-operated screw conveyor mechanism is being innovated to overcome the above problems faced. These inventions are numerically evaluated at the concept development level by employing Computational Fluid Dynamics (CFD) of gas-solids multiphase flow systems. CFD has been very helpful in development of such devices saving time and money by reducing the number of prototypes and testing. Furthermore, this paper describes a simulation of powder dispensation from the trocar's end by considering the powder as secondary flow in air, is simulated by using the technique called Dense Discrete Phase Model incorporated with Kinetic Theory of Granular Flow (DDPM-KTGF). By considering the volume fraction of powder as 50%, the transportation of powder from the inlet side to trocar's end side is done by rotation of the screw conveyor. Thus, the performance is calculated for a 1-sec time frame in an unsteady computation manner. This methodology will help designers in developing design concepts to improve the dispensation and also at the effective area within a quick turnaround time frame.

Keywords : DDPM-KTGF, gas-solids multiphase flow, screw conveyor, Unsteady
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