

Shao Y-L, M.E.Sc., "A Novel Fluidized Bed Feeder for Tablet or Capsule Filling and other Processes", The University of Western Ontario, September 2001.

Abstract

A novel fluidized bed feeder has been developed for accurately dispensing small quantities of particulate materials in the pharmaceutical and other industrial processes. This new feeder consists of a cylindrical fluidized bed to suspend the powder, a mechanical stir to further agitate the powder flow and a roller with four shallow slots to transport the dispensed quantity out from the bottom of the feeder. Studies with this novel fluidized bed feeder were carried out with six different types of powders, flour, glutinous rice powder, corn meal, poppy seeds, ground black pepper and corn starch, covering from Group C to Group A and then to Group B powders. Tests with all powders but the corn starch led to very positive results – steady flow of the fine powder and accurate dispensing of the required dosage. Larger particles produced better results due to the smoother fluidization. Corn starch did not work due to severe channeling.

Flour powder (55 μ m) was used to optimize the feeder operation. The best operation condition with flour powder was at $U_{bed} = 0.01$ m/s, $U_{dis} = 0.11$ m/s, and $H_{bed} = 7$ cm. Parametric studies showed that the auxiliary distribution air velocity has the most significant influence to the feeder operation. When it was lower than the required to fluidize the particles in the neck area, the operation was not steady due to the form of bridges especially in the bed bottom exit and the slot entrance. When the distribution air velocity was increased to beyond this threshold value, the operation become steady and the outlet dosage was found to increase slightly with the increase of the fluidization velocity, due to the increased bed voidage with increasing air velocity.

Comprehensive statistical analysis was carried out to prove the significance of the experimental results. Standard deviation and relative standard deviation were used to calculate the confidence level and the student t-test was used to verify the significant difference between different tests under different conditions. There were very strong evidences that the differences in test results between different operation conditions were significant and the mean dispensed values under each operating conditions had high confidence level.