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Residence Time Distribution of a Continuously-operated Capsule Filling Machine: Development of a Measurement Technique and Comparison of Three Volume-Reducing Inserts

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Abstract

This paper presents the measurement and analysis of the residence time distribution (RTD) of a tamping-pin capsule filling machine. The tamping speed and the amount of material inside the powder bowl proved to have a significant effect on the RTD. Various inserts into the powder bowl that reduce the volume and alter mixing and transport in the bowl were experimentally investigated. To obtain the RTD, a tracer-based measurement method was applied and a sophisticated data processing strategy was developed. The tracer-based method also allowed investigations of stagnant zones in the powder bowl, another important aspect in continuous manufacturing (CM). The suitability of tracer material was assessed based on a detailed characterization of bulk and tracer material. Characteristic parameters of the RTD were extracted and compared, proposing a systematic strategy for selection of a suitable insert.

Keywords: continuous manufacturing, capsule filling, residence time distribution

1 Introduction

Continuous manufacturing (CM) is increasingly gaining interest in the pharmaceutical industry for many reasons. For example, there are fewer scale-up issues and higher flexibility can be achieved in terms of production volume. Moreover, since storage capacities can be optimized, an effective supply chain management can lead to a reduction of the footprint of a plant [1–3].

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