

For people operating industrial production facilities in the bulk solids industry, steadily escalating product-characteristic requirements and rising quality standards make it challenging to handle very small quantities of pigments and other additives. Since such additives often exert a crucial influence on the multifunctional characteristics of the end products, any deviation in dosage can have major impacts. Therefore it is particularly important for the investor/operator to choose and install reliable systems. This article presents a potential system approach with which to get and keep the matter under close control, with maximum accuracy and flexibility.

TEXT Jörg Schreck, Divisional Sales Director, m-tec group, Neuenburg/Germany

M-TEC MATHIS TECHNIK GMBH

Perfect dosing – precise and reproducible

1 Introduction

Across the bulk solids processing industry, the automatic dosing of small and very small quantities still presents a challenge, especially with regard to the precision and reproducibility of completed production orders. Manual dosing can lower both productivity and efficiency while increasing the risk of human error.

Dosing, weighing and feeding are routine tasks in the bulk solids processing industry. Today's plants are designed for the completely automated addition of major, intermediate and minor constituents and their further processing. However, many very small-quantity constituents still tend to be weighed by hand for feeding into the downstream processes. There are many possible reasons for this: Perhaps the plant concept included no automatic addition equipment for lack of space, or a limited investment budget precluded the relevant

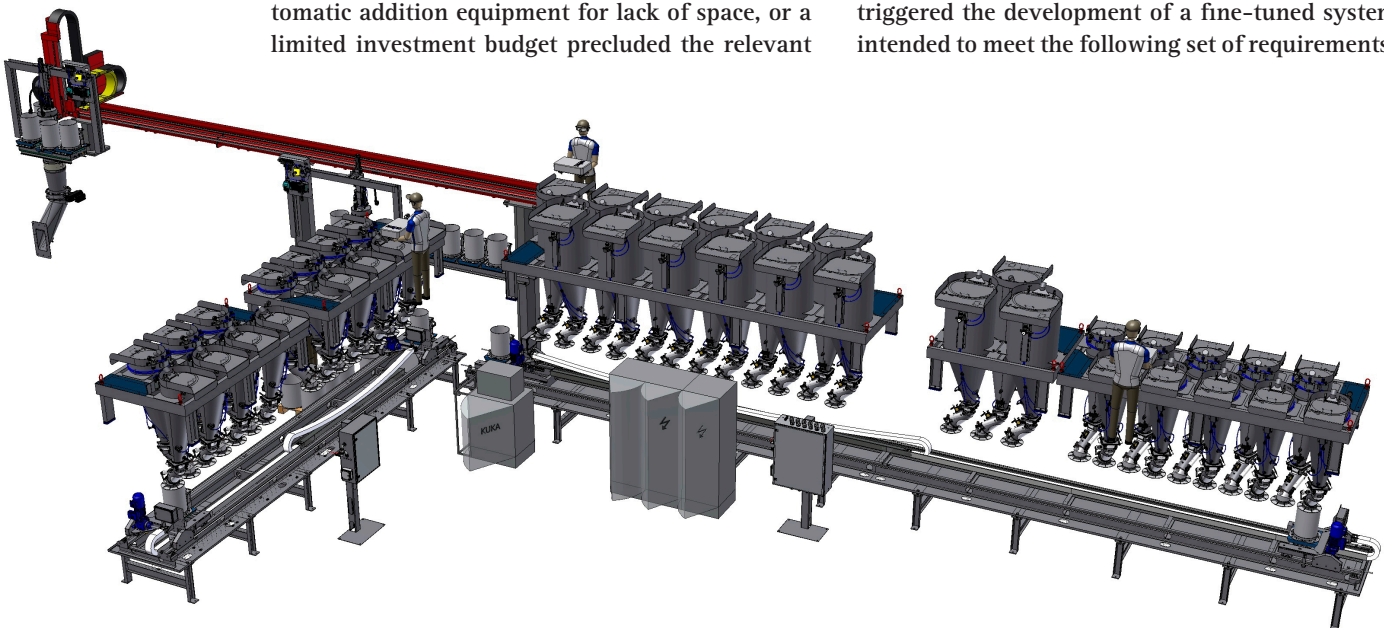
expenditure, or no suitable dosing system could be located. Whatever the reason, the result is not only inefficient, but also carries a risk of human error, and it takes accordingly more effort to achieve reproducibility and consistent batch tracking.

2 Determinative: solution expertise

Apart from manual dosing, the two main conventional dosing options for minor constituents are proportioning screws and vibratory feeders in conjunction with appropriately designed scales. These options are time-tested and relatively simple, but of limited scope and often rather slow (Figure 2 and Figure 3).

Standard-type, commercially available systems often prove inadequate for certain, special application problems. Now, that very problem has triggered the development of a fine-tuned system intended to meet the following set of requirements:

1 Gravimetric precision dosing of dry, fine-grain bulk solids with Powerdos



All m-tec

- » precise, dust-free dosing of multiple minor and trace constituents
- » high-accuracy, close-tolerance gravimetric dosing
- » dosing of sundry dry powders, slow-flowing products and granulated material with grain sizes up to approx. 5 mm
- » flexible dosing range (from single-digit gram range to double-digit kilogram range)

With deference to the increasingly complex challenges posed by today's technical solutions, a modular, fully automatic micro-component dosing system for operation both online and offline has now become available.

Thanks to many long years of experience in the development, engineering and design of such equipment, in combination with intensive interdisciplinary know-how and application experience, m-tec was able to hone and refine this dosing system.

The Powerdos dosing principle emulates the natural process of manual dosing in the laboratory. For example, in order to increase the flow of powder, you simply tap the spatula with your finger a little more intensively. This tells the Powerdos system to increase the oscillation frequency of the dosing valve and to raise the amplitude in order to accelerate the dosing rate (Figure 4).

The raw materials are dosed via a vibrating rubber valve in an inclined rubber tube, at the end of which an orifice widens or narrows, depending on the intensity of actuation. The flow of material is controlled by an advanced type of control module. The system doses the material into a mobile or stationary hopper scale, all according to the specified formulation.

Figure 5 compares the dosing tolerances of a conventional screw feeder weighing system "AW" with those of a Powerdos system "PD2".

The Powerdos system enables mass-flow and dosing rates across the very wide range of 0.5 – 500 g/s.

3 Automatic dosing of minor constituents in plant engineering and construction

3.1 Online system

If the main focus is on residue-free discharge, the fully-automated inline minor-constituent series-dosing system with hopper scale and automatic product conveyance to the discharger is the recommended solution (Figure 6). The system doses the proper amounts of specified constituents into the mobile hopper scale, which then moves on to the discharger at the end of the line, where the hopper is emptied and cleaned from all residue. The now empty container is immediately ready for the next dosing step.



The dosing system can be equipped with an optional active dust removal system for dedusting. The individual dosing points, feed silos and weighing vessels can be vacuumed out after emptying.

Different sizes of raw material silos are available. The feedstock can be taken from sacks or big bags. The system offers multiple advantages:

- » system accuracy up to +/- 2g for free-flowing products
- » guaranteed batch tracking and reproducibility
- » dosable range between 2 g and 60000 g per batch

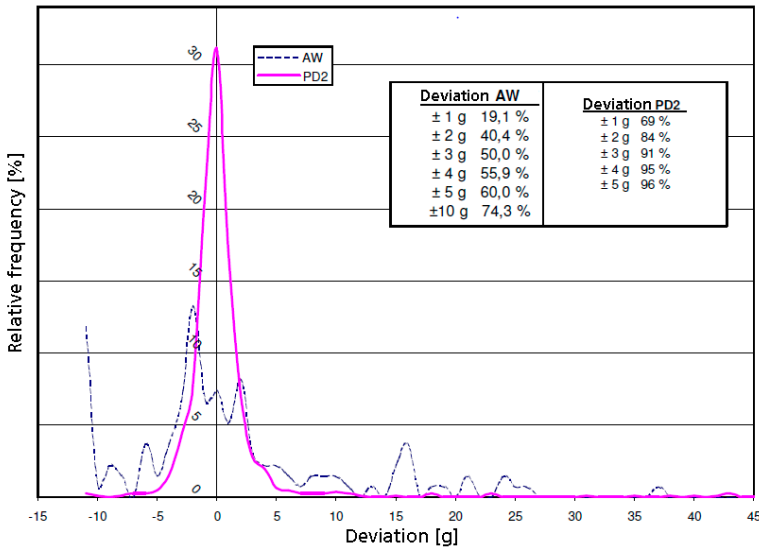
2, 3 Conventional dosing via proportioning screw into hopper scale

3.2 Offline system

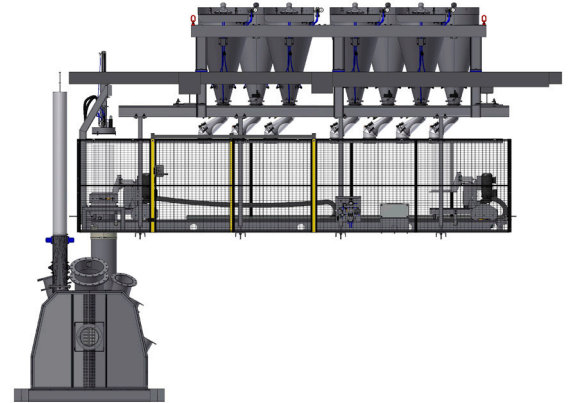
If, however, flexibility is what counts most, an offline version of the fully-automated minor-constituent series-dosing system with mobile hopper scale is recommended (Figure 7).



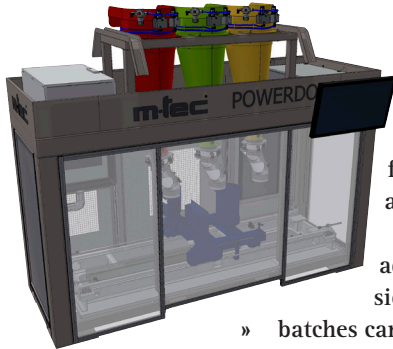
4 "PneuDos" dosing valve



5 Comparison of dosing tolerances: wormtype scale system vs. Powerdos



6 Inline Powerdos system



7 Offline Powerdos system

In this configuration, the dosing vessel itself can either be removed for forwarding the batch or fitted with some kind of lining, e.g., a plastic bag.

The offline system offers several advantages against the online version:

- » batches can be pre-produced
- » several mixing systems can be fed at the same time

3.3 Compact system

The compact system comprises a fully-automated minor-constituent dosing system with hopper scale and optional pneumatic product transport to the downstream process (Figure 8).

The dosing valve feeds into the hopper scale as prescribed by the formulation. The scale, in turn, empties either directly into the downstream process (e.g., batch mixer) or into a pneumatic conveying unit. The main advantages of this version are:

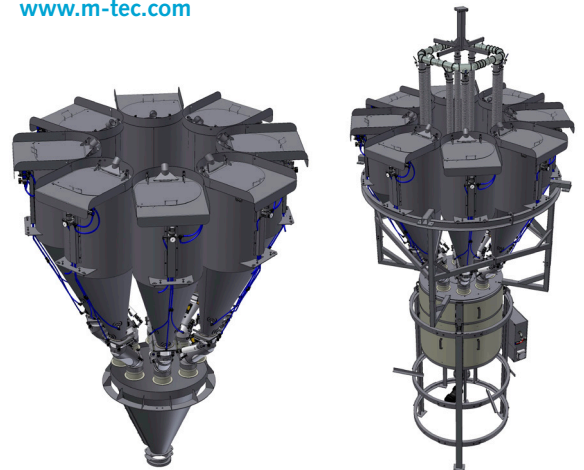
- » system accuracies up to +/- 5 g achievable for adequately fluent grains and powder
- » guaranteed batch tracking and reproducibility
- » dosing range of 50 g to 210000 g per batch
- » easy retrofitability

4 Outlook

m-tec is a successful German company offering abundant know-how acquired in numerous branches of industry and diverse countries and spanning 40 years of experience in bulk solids technology. Each individual system is tailored to the customer's own technical and commercial requirements.

This enables owner-operators to provide their customers with products of consistently high quality, for now and in the future.

www.m-tec.com



8 Powerdos compact system

REFERENCES

- [1] Kamp, M.: The automated dosing of admixtures in the production of dry premix mortars, Part 2, ZKG International 7-8/2011, pp. 64-74
- [2] Knöpfle, X.: internal R&D m-tec documents, 2012
- [3] Moser, K.: internal R&D m-tec documents, 2014