Testing the feed mill's working precision

by Detlef Bunzel, Evonik Industries, Health & Nutrition feed additives, Hanau, Germany

A testing system has been developed to monitor the working precision of the feed production plant. The AMINOBatch® Working Precision Test (WPT) is based on amino acid analysis and is a valuable tool for the feed industry to benchmark and improve the mixing and dosing processes.

The working precision of a batch mixing line can be evaluated on the basis of three measurements. The first is homogeneity, which gives an indication of the distribution of each ingredient in the batch. The second measure is repeatability, which is the ability of the mixing line to produce consistent consecutive batches. And the third is cross-contamination, which is the unintentional carry-over of a certain substance from one batch to the next batch produced on the same line. Measurements based on these three dimensions will give an indication of the working precision of the mill.

The basic mixer test

The first dimension, homogeneity, can be measured using a basic mixer test. The mixer is filled with all ingredients according to the formulation and the test substance is added into the mixer. The mixer is operated according to the production plan and then a number of representative samples are taken from the mixture. The concentration of the test substance in each sample is analysed to obtain the mean concentration, from which the coefficient of variation is calculated.

AMINOBatch® is Evonik's basic mixer test based on amino acid analysis of supplemented amino acids and using assays per sample to calculate the Coefficient of Variation (CV) of the analytical results.

Performing this test not only at one point in time, but with incrementally increasing mix times will show how the batch homogeneity, measured as CV, depends on mixing time.

Choice of tracer

Meaningful results rely on good choice of a tracer. Besides accurate analysis of the tracer level in the samples and particle size distribution there are many properties of the tracer which influence the interpretation of results. The tracer should obviously be non-toxic at the concentrations used. It should not be present in the raw materials (to ensure low blind levels) and should have no negative impact on organoleptic and nutritional properties of the feed. Stability under the process conditions (humidity, temperature, and pressure) is important, as is the suitability to mix with different premix and feed formulations. Finally, the tracer should have an established, precise and verified analytical method with good repeatability.

Studies carried out at Kansas State University by Behnke and co-workers with a range of tracer materials concluded that DL-Methionine and L-Lysine·HCl were the most consistent markers. The work highlighted the importance of reliable assay determination. The laboratories of Evonik have a long established experience in amino acid wet chemistry analysis, with several hundred mixer tests being performed annually.

AMINOBatch® WPT

The basic AMINOBatch® mixer test has been adapted and extended to develop the AMINOBatch® WPT. This test allows measurement not only of homogeneity but also repeatability, thus allowing a more meaningful evaluation of the mill's working precision also on the second measurement level.

The starting point is the production of five batches with identical composition under the usual production conditions. The first two batches are used to flush the mixer and the conveying line. The time for conveying per batch is registered and divided by eleven (i. e. the number of samples plus one) to define the sampling interval.

Batch three is the first sampling batch. Ten samples are taken at the calculated time intervals, from a conveying line as close as possible downstream of the mixer. Batch four then flushes the system again and a sample is taken from this batch to check the particle size distribution and the bulk density.

After the fifth batch the second set of samples is taken and samples are packed into a sampling box and shipped to the laboratory for amino acid analysis.

Results of AMINOBatch®WPT allow process optimization

The two samples sets (batches 3 &5) taken during the AMINOBatch® WPT are summarized as shown in Figure 1. The summary sheet shows the target as nominal supplementation rate and the absolute weight of the supplemented product (e. g. lysine 50 % and total lysine supplementation), mean value of the two sample sets, and recovery (analysed mean / target value) for all supplemented amino acids. In addition, technical data of the dosing and mixing plant are also taken to allow full interpretation of the results. The customer receives a detailed report with the results of the mixer profiles including an interpretation. Based on this, recommendations for process optimization are given.

Meeting the feed industry's needs

As the AMINOBatch® WPT is based on the analysis of amino acids it is generally performed on the original formulation without the necessity of adding separate tracers; the supplemental amino acids serve as markers. This way, comparative data for several supplemental amino acids are delivered in parallel. Moreover, AMINOBatch® WPT is the only well-established mixer test that delivers comparative data for supplemental amino acids added dry and those supplemented as liquid sources.

As no additional tracer is required there is no contamination of the product, and no interruption of production. The test allows the feed industry to benchmark and improve the mixing and dosing process based on amino acid analyses. Based on the outstanding advantages it can be concluded that AMINOBatch® WPT meets the feed industry's needs for a reliable and robust test procedure for a feed mill.

Figure 1
Output of AMINOBatch® Mixer Profile – summary of results of two mixer profiles.

Results

Summary

Sample Customer

Poultry feed	Batch size 3000 2 Sequences of samples 10 samples per sequence 100 g / sample

Product	target (%)	mean value (%)	recovery (%)	CV (%)
Liquid Lysine 50 %	0.488	–	–	–
calculated as **L-Lysine**	0.244	0.213	87	8.0
	–	0.261	107	20.6
weight (kg)/batch	14.64	–	–	–
DL-Methionine	0.281	0.268	95	6.1
		0.288	102	4.2
weight (kg)/batch	8.43	–	–	–
L-Threonine	0.075	0.080	107	8.1
	–	0.073	97	5.2
weight (kg)/batch	2.25	–	–	–

Summary of results of two mixer profiles

Evonik Degussa GmbH
Health & Nutrition
feed additives
Rodenbacher Chaussee 4
63457 Hanau-Wolfgang
Germany

PHONE +49 6181 59-2256
FAX +49 6181 59-6734

feed-additives@evonik.com
www.evonik.com/feed-additives

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