STAYING DRY MINIMISES CROSS-CONTAMINATION

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The results of a new study show that using dry additives, rather than liquids in feed, reduces the occurrence of caking and lumping in the mixer and can help prevent cross contamination.

Cross-contamination in the mixing process results from the unintentional carry-over of a substance or ingredient from one batch to the next, produced on the same line. When changing batches, product from the batch that is currently being discharged will remain inside the equipment and be 'carried over' into the next batch.

The problem becomes more obvious when the feed formulation is changed. For example, an additive may be used in a certain batch, but may not be intended to be present in the consecutive batch. Nevertheless, a certain level of this additive may be carried over and contaminate the next batch. Keeping cross-contamination to a minimum is obviously a major issue for feed manufacturers and is an essential part of any quality control programme.

How cross-contamination occurs

Levels of cross-contamination have been found to be higher when liquid feed additives are used, compared to when feed is based on dry ingredients. Conditions in the batch mixer do not favour liquid spraying, partly due to powder incrustations on the nozzles. While the particle size of dry bulk additives is well optimised to blend into feed mash, liquid nutrients, when sprayed into the mixer, lead to an increase of particle size. Any liquid droplet sprayed into a dry powder mix will immediately bind several particles by adhesion, substantially increasing the particle size. Dust and finer particles will bind to the bigger particles.

Table 1: Concentration of amino acids in poultry feed samples

Poultry Feed Sample code	Methionine %	Threonine %	Batch 5 Lysine % (added liquid)
xxx20	0.275	0.067	0.233
xxx21	0.294	0.075	0.248
xxx22	0.299	0.076	0.230
xxx23	0.296	0.076	0.250
xxx24	0.299	0.074	0.243
xxx25	0.269	0.074	0.244
xxx26	0.292	0.070	0.256
xxx27	0.289	0.070	0.234
xxx28	0.268	0.067	0.411
xxx29	0.295	0.077	0.256
Mean	0.288	0.073	0.261
Std. Dev.	0.0123	0.0038	0.0537
CV %	4.2	5.2	20.6

Under field conditions, the dosing and mixing sequence for dry and liquid additives is rarely optimised for best overall performance. It is often compromised by a too short dry mixing time, overlong spraying time and excessive addition of liquids in the main mixer.

The result of the less-than-optimum conditions is that micro-ingredients accumulate in adherences on the mixer walls. Not only will they be missing in the samples of this batch; when they eventually break loose they will increase the supplementation rate of the following batch.

Measuring cross-contamination

The concentration of a certain substance in each batch, which is not part of the current formulation but has been carried over from a previous batch, can be taken as a measure of the level of cross-contamination under certain mixing conditions.

Evonik carried out an evaluation of mixing lines to look at differences between dry and liquid additives. For each of the mixing lines, at least two sets of samples were collected. The data allowed us to compare results from the addition of dry and liquid additives in the same mixer. In most of the cases, two to four amino acids were added to the mix, and of these amino acids, usually one or two were added as a liquid, and one or two were added as powder.

High carryover found when liquids used

With liquid addition, inconsistencies in recovery rates of consecutive batches were found in several cases. If this coincided with a high coefficient of variation for the second batch due to an extremely high peak value in one sample of the second mixer profile, we assumed a carry-over of additives from an earlier batch.

Values in Table 1 show the results of a batch of poultry feed. The peak value of 0.411 percent for lysine, which was added as liquid lysine 50 percent (batch five, sample code xxx28) appears to be much higher than the mean value (0.261 per cent) and this difference is explained by carry over. The carry-over may be caused by adherences breaking off the mixer wall.

In a survey carried out by Evonik, we found that more than three quarters of the results for dry amino acid addition were acceptable, whereas with addition of the liquid amino acid sources nearly half the results were bad.

Lumping increases risk of cross-contamination

The risk of cross-contamination is increased when liquids are used, as the resulting lumping and agglomeration increases the likelihood of carryover. Depending on the consistencies of the main and minor ingredients, insufficient absorption can also lead to adherences in the mixer and conveying line.

The addition of several liquids poses further problems. Several liquids sprayed in parallel to the same area in the mixer will result in a high amount of liquids in certain parts of the mash, leading to the formation of lumps. Often, the liquid present in the dosing header between the flow control vale and the nozzles empties itself by gravity into the mixer. These drops are large compared to the size of the solid particles and tend to form clusters or lumps which sequester the liquid additive and prevent its proper mixing.

Any of the above problems can lead to increased adherences, increased carryover and a greater risk of cross contamination. Ensuring that wherever possible dry additives are used, will help to avoid these problems and minimise cross-contamination.