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PHYTASE STABILITY DURING PELLETING OF BROILER FEED

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ABSTRACT

A phytase recovery trial was conducted evaluating the heat stability of five different commercial phytases during pelleting at 85ºC. All commercial phytases tested presented expressive losses of enzyme activity. Phytase activity recovery ranged from 35.3 +1.82% up to 64.7+7.92% after pelleting. This activity loss pattern is very high indicating that feed industries have to adjust the inclusion rate of enzymes in order to end up with the desired phytase activity in the feed.

KEYWORDS: feed processing, enzyme, heat stability.

INTRODUCTION

Enzymes are routinely added to monogastric diets in many parts of the world. However, enzymes are proteins and such are susceptible to the rigours of feed manufacture, as are all other feed proteins (Bedford, *et al.*, 2001).

For many years, feed has been pelleted, a process whereby the feed mixture is conditioned by adding steam, then pressed through a die. Pelleting increases nutrient density, improves the handling characteristics of the feed, and reduces the microbial load. Pelleting commonly uses temperatures between 65 and 95ºC (Gibson, 1995), which can be damaging to heat-sensitive nutrients, including enzymes.

There is a general agreement that, for optimum broiler performance, conditioning temperatures over 85ºC should be avoided. These findings imply that type of the diet, heat processing method, conditioning time, moisture employed, temperature used and age of the birds should be considered in any model attempting to predict the response of broilers to added enzymes. Data on the effects of conditioning practices on enzyme recovery and broiler performance are scare, and need to be evaluated in more studies (Amerah, *et al.*, 2011)

The objective of the present study was to evaluate heat stability of five different commercial phytases in broiler diets during pelleting.

MATERIAL AND METHODS

The trial was carried out at the SEA (Section of Poultry Experimentation) – Feed Manufacturing Plant, EmbrapaSwine and Poultry, Concórdia, SC, Brazil, in November 2011.

A Koppers pelleting equipment was used, with a production rate of 50 kg/min, operating at 85°C and residence time of 10 seconds, matrix hole 4.2 mm and 1.44 holes per cm2. A standard broiler growing diet was formulated (Table 1). An one batch diet (1250 kg) was divided in to six amounts (250 kg). The first amount was considered as the control and had no phytase addition; all subsequent amounts were supplemented with commercial dry form phytases, corresponding to the positive treatments, added in an amount corresponding to a 500 FTU/kg of diet, assuming specification presented on the product label. All treatments were pelleted in a one-time run and between treatment wheat bran was pelleted to ensure the removal of residual phytase from the former treatment. The first and the last 20% of each treatment volume were discarded. Three samples were collect in a time intervals corresponding to approximately 20% of the treatment volume (total 5 minutes).

Samples were collected and submitted to cooling procedure simulating the industrial conditions, packed in plastic bags, labeled and submitted to phytase analysis, according AOAC (2005).

Data indicate that control treatment presented 20 FTU/kg before and 10 FTU/kg after pelleting, which corresponds to the content of natural phytase coming from raw materials used to compose the diets.

Five treatments were tested (commercial dry form phytases), all treatments had 3 replicates (sampling

time) and data were analyzed through SAS GLM procedure (SAS, 2008) and means compared through Tukey Test, 5%.

Table 1 – Composition of the experimental diet and nutritional profile.

Ingredient	%	Nutrients	Level
Corn	66.93	AMEn (kcal/kg)	3,050
Soybean meal	26.55	Crude protein (%)	16.60
Dical Phosphate	1.81	Calcium (%)	1.00
Limestone	1.27	Total Phosphorus (%)	0.67
Salt.NaCl	0.44	Available Phosphorus (%)	0.44
Soy oil	2.24	Sodium (%)	0.18
Min+Vit Premix + BHT	0.30	Ether extract (%)	5.11
Choline Chloride	0.23	Crude fiber (%)	2.56
Coban 400 + Tylan	0.03	Ash (%)	5.85
Toxin Binder	0.20		

RESULTS AND DISCUSSION

Based on the experimental data (Table 2). it is clearly shown that all commercial phytases presented significant losses of enzyme activity after pelleting were conditioning temperature was set for 85ºC for 10 seconds. The phytase activity recovery ranged from 64.7 % for product T1 which was the most thermostable in this study and the less stable presented a recovery of 35.3% (T2). All other enzymes (T3. T4 and T5) presented an intermediate recovery rate (approximately 50%) and did not statistically differ from T1 and T2.

Table 2 – Phytase recovery (FTU/kg feed) before and after broiler feed pelleting (85ºC- 10 sec.).

Treatment	Pelleted before pelleting	Mash			Mean	% Recovery
		Sample 1	Sample 2	Sample 3		
T1	530	270	410	330	340+40.4 a	64.71+7.92 a
T2	345	135	115	130	126.7+6.0 b	35.35+1.82 b
T3	170	90	95	110	98.3+6.0 b	58.89+4.01 ab
T4	330	175	140	145	153.3+10.9 b	46.24+3.53 ab
T5	540	295	235	330	286.7+27.2 a	53.21+5.33 ab
Prob> F	---	---	---	---	0.0004	0.0316
CV. %	---	---	---	---	21.34	17.78

Tukey. 5%

Other additional point was that the enzymes were dosed according enzyme activity declared on the label and based on that, the goal was to achieve 500 FTU/kg feed in all mash feed samples. However, as presented in Table 2. there was an enormous variation between products. This makes such evaluation much more difficult. Another hypothesis is that the enzymes had already some losses during storage and handling. even all products were stored under similar condition before running the trial and all products were in their shelf life term.

Based on these data, feed producers should be careful in case of using dry phytase products during pelleting process. An alternative to overcome such problem could be overdosing enzymes in order to achieve the expected activity at the end of the process.

CONCLUSION

The data indicate that the commercial phytases evaluated during pelleting (85 ºC for 10 seconds conditioning) showed significantly enzyme activity losses.ranging from 35 up to 65%. In the practice a overdosing should be considered.

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