Making it easy to choose the right phytase!

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That exogenous (added) phytase has become a staple ingredient in most pig and poultry diets worldwide is hardly surprising. Not only does phytase help reduce environmental pollution by increasing the digestibility of the scarcely digestible plant-derived phosphorus, but it also improves feed efficiency, animal growth, and most importantly profitability of animal production.

Thus, the use of phytase is no longer a question in the minds of most professionals. It is rather the more perplexing issue of having to pick the 'right' phytase from a myriad of available products, all with more or less similar claims. Clearly, this is quite confusing!

Without doubt, the technical and scientific literature is replete with efficiency reports for every single commercial product; each examining all aspects concerning the commercial application of a phytase in pig and poultry diets. Yet, they all tend to point to the fact that most modern products are quite effective when it comes to releasing vegetable phosphorus.

Heat stability

The glaring gap in the literature is in the area of heat stability, and especially when it comes to side-by-side comparisons among different products – especially when it is more than two products that are compared.

Cereal	Phytase (units/kg)
Winter barley	580
Spring barley	1000
Wheat	1050
Triticale	1100
Rye	360
Oats	50

Table 1. Natural phytase content in common cereals.

This is what is missing today, and it is the last piece of the puzzle commercial nutritionists are called to complete, so far with incomplete data. So, how is this now remedied? Natural ingredients, such as cereals that make up the majority of any pig and poultry diet, contain a certain (low) level of 'natural' phytase (Table 1).

This phytase is activated when the kernel germinates to release bound phosphorus for the energy needs of the new plant. Exogenous phytase mimics this process in the gastrointestinal tract by releasing this bound phosphorus making it thus available to the animal.

Being similar, both natural and added phytase share another common feature: they are both extremely sensitive to exposure to high temperatures, such as those encountered during pelleting, for example. This has to do with their very own nature, in that being proteins, they are heat sensitive (only a few proteins are naturally heat resistant).

Thus, exposure to excessive heat reduces their efficacy and as such they release less phosphorus. Because of this, a high recovery (or resistance) to heat is a desired feature in commercial phytase products.

To make exogenous phytase heat stable, its formulation (enzyme and carrier) and coating processes require a certain degree of sophistication and technology that today is patented. Yet, not all commercial products enjoy the same efficacy in being made heat resistant.

Simple trial

A study was conducted at the Danish Technical Institute in Kolding aiming to compare five commercial phytase products in terms of heat stability (Table 2).

Clearly, with these five, the vast majority of commercial application of added phytase in pig diets is covered in a global approach.

For the trial, a single batch of a typical diet was prepared. This was based on wheat and soybean meal.

Afterwards, sub-batches of 300kg were mixed with one of the enzyme products (Table 2), while one sub-batch was kept without any added enzyme as a negative control. The common initial batch of feed ensured that any inherent inaccuracies in feed preparation and mixing would not affect the trial.

In addition, the common ingredients ensured that any biological variation in nat-

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Fig. 1. Average natural phytase activity at different conditioning temperatures at 60 seconds.

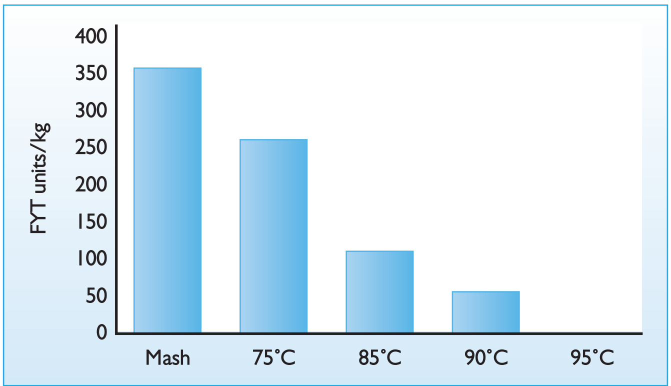
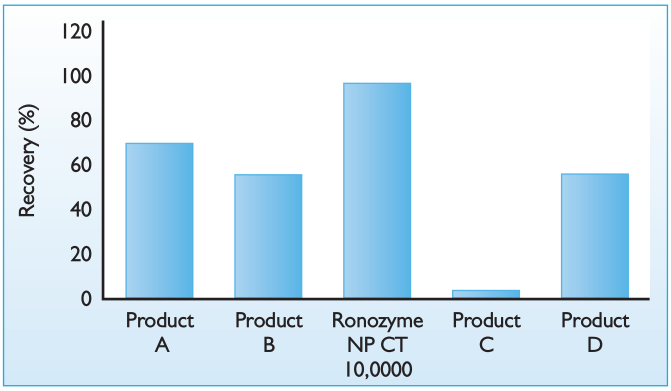


Fig. 2. The recovery of different commercial phytase products.



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ural phytase would not be an issue in this trial. The double dosage of enzyme ensure that the contributions from natural phytase were minimised, and that the samples collected contained enough added phytase for an accurate analytical determination at the laboratory.

Each diet was then subjected into different temperature and time variables, while being in the conditioner compartment of the pelleting machine. The holding times were 30, 60, 90, and 120 seconds, whereas temperature was 75, 85, 90, and 95˚ Celsius. The negative control diet that was not pelleted was held at 20º Celsius.

All in all, for each product, 16 samples were collected, one for each time x temperature combination. Results confirmed that natural phytase is indeed extremely sensitive to heat exposure (Fig. 1).

From 364 units/kg in the negative control, it dropped linearly with increasing temperature, reaching zero activity for the diet held at 90º Celsius for 60 seconds. Obviously, there is little that can be done for this, apart from ignoring natural phytase contributions in pelleted diets!

Results concerning the added enzyme were equally revealing (Fig. 2). One of the products (Product C) was virtually non-resistant to heat as its recovery was just 3% when exposed to 95º Celsius for 120 seconds. Another product from the same supplier (Product D) was more stable (almost 60% recovery), meaning the two products are formulated and coated differently. This alone gives an indication of the extreme variability in quality characteristics that exists today in the market.

Product	Enzyme unit per kg feed	Product dosing (g/t)
Product A	1000 FTU	100
Product B	1000 FTU	100
Product C	1000 FTU	200
Product D	1000 FTU	100
Ronozyme NP CT	3000 FYT	300

Table 2. Dosage of enzymes used in the comparison trial.

The most stable product was Ronozyme NP CT 10,000, which even at the most extreme conditions tested, showed a remarkable, almost complete, recovery (98%), even at 95º Celsius for 120 seconds.

This clearly demonstrates the superior patented process of formulation and coating applied by its manufacturer. It also proves that added phytase destruction during pelleting is not a fact that has to be accepted as inevitable, when new technological advancements can make phytase heat resistant.

All other tested phytase products were intermediate in their resistance to heat exposure, with values ranging around the 60% mark, implying a similar (older) formulation and coating process used by several manufacturers.

Practical implications

Clearly from this trial, it would be safe to assume that for pelleted feeds, not all commercial phytase products should be considered equal. There are products that should be avoided, as they are clearly not intended for being exposed to thermal processing.

In contrast, the majority of commercial products give satisfactory, yet not complete, resistance during pelleting.

In comparison with Ronozyme NP CT 10,000, which gave almost complete recovery and full resistance to harsh pelleting conditions, the other products have considerable wastage.

The issue of percentage recovery is not only a matter of how much phosphorus will be released once the animal ingests the feed. Clearly, a lower recovery rate will provide less phytase to the animal, which in turn will release less vegetable phosphorus, reducing thus animal performance and overall profitability.

This issue can be resolved by increasing the dosage of the added phytase. And here is where real economics should be applied.

When phytase products are compared, their heat stability index should be part of the equation, as an apparently less expensive product to buy may be at the end the most expensive (or less effective) to use. ■