INTERVIEW: DSM Looks at Extra-Phosphoric Effects of Phytase

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20 November 2014 - In recent months DSM has studied the 'extra-phosphoric' effects of phytase when included at high levels in animal diets, and has identified new opportunities for the industry.

DSM researchers have turned their attention to the role of the molecule myo-inositol, which appears to play an essential role in the resulting increased animal performance, in terms of growth and feed conversion.

At EuroTier last week, Feedinfo News Service spoke to Dr. David Nickell, Vice President Global Marketing, as well as Neil Duijster, Category Manager Enzyme EMEA at DSM, to find out more about the company's novel angle in phytase research and what can be expected in practice with regard to DSM's own phytase product, RONOZYME® HiPhos.

[Feedinfo News Service] DSM’s recent focus of phytase research has shifted to myo-inositol. Can you talk about the significance of this molecule?

[Neil Duijster] Phytate, the substrate for phytase, is composed of around 70% phosphate and 30% myo-inositol. If phytate is broken down in the correct way by phytase, it will facilitate release of myo-inositol. Myo-inositol is a unique molecule that lately has received a lot of attention, not only in animal nutrition, but also in other scientific areas like diabetes and cancer research. The reason it receives so much attention is because it has properties that influence cellular metabolism. Although animals are able to synthesis myo-inositol themselves, it has been demonstrated in several studies that when added to diets, animals show a more efficient and sustainable performance. Until recently, the focus of phytase research has been understanding the effect on Ca:P ratio and more complete degradation of phytate. It is curious that we have seen such disproportionate attention given to phosphorus while inositol was overlooked.
[Feedinfo News Service] When did DSM initiate this shift in focus to myo-inositol and what have you discovered so far?

[Neil Duijster] We started to integrate the aspect of myo-inositol in our research program about 3 years ago. Our interest was encouraged when we conducted our dose-response experiments with RONOZYME® HiPhos. It quickly became apparent that at increasing doses of the product, animals consistently performed better than in our nutritionally-adequate control diets. Although observed in the scientific community earlier, there were only hypotheses about what triggered these effects. We set out to better understand the mechanism behind it. Since we started our work, we are the first to demonstrate that RONOZYME® HiPhos significantly increases myo-inositol concentration in the blood plasma of both poultry and pigs. These effects are related to both phytate concentration and phytase dose. We went on to draw links between this effect and pathways involving protein accretion and glucose uptake. This is extremely significant and very exciting. There are still many questions to answer, but we have several new publications lined up that will move us in the right direction.

[Feedinfo News Service] Have your discoveries concerning myo-inositol and increased animal performance been noticed on the farm yet? What can the industry expect in practice from this novel application?

[David Nickell] The application already knows substantial use in practice. Our practical recommendations currently include broilers, piglets and grower pigs. We see effects on feed conversion as well as growth in these species. It seems that piglets respond even stronger in growth than broilers do. Although it is difficult to generalize, I can safely say we see growth benefits of +2-3% as a minimum for broilers and piglets. In many cases, this is higher. Where we see feed conversion effects, these tend to be 1-2% lower as a minimum, again with cases of 3-7% improvement.

[Feedinfo News Service] Does the company plan to reformulate RONOZYME® HiPhos to better take into account your new findings?

[David Nickell] All of our research on the topic is generated using RONOZYME® HiPhos. In my opinion this shows that there is much value to be gained through the application of HiPhos. Our first aim is to make best use of the opportunity that is available to the industry now and continue to grow our scientific understanding and application dossier. Of course, we are also considering the aspect of extra-phosphoric-effects in our product innovation program.
An active debate is ongoing in the industry around the topic of high phytase doses. How does DSM's stance on the topic of high phytase doses differ?

Neil Duijster
Category Manager Enzyme
EMEA
DSM

The debate on phytases has shifted from a focus on cost-savings to now also include animal performance. The main thing we are doing is adding to the debate. We have invested heavily in the topic and will continue to do so to improve our application advice, potentially in other species or life-stages. Based on our understanding of the mode-of-action we consider myo-inositol to be the third pillar of phytase efficacy. The effects of myo-inositol appear to be completely independent from the benefits that phytase brings on phosphorus digestibility and reduction of the anti-nutritional effect of phytate. An interesting implication is that any extra-phosphoric-effects show on top of our recommended matrix values. This means we can maximize cost-savings and in addition improve performance.

You say that this year DSM has discovered a new role of phytase that mainly expresses its benefits when included at high levels in animal diets. Another phytase producer has been using the term "superdosing" for a few years now. Can we really talk about a DSM discovery here?

This is not about applying higher doses, this is about getting the most benefits out of phytase use. The novelty of the discoveries by our talented R&D team is in understanding what actually happens. So not only the 'what' but also the 'why'. We have worked in recent years to get a thorough understanding of the working mechanism behind these extra phosphoric effects. Our in-depth scientific expertise means we are in a leading position to advise the market of its optimal use in practice.

Another phytase producer recently said that not every phytase can achieve better results with high phytase dosing, and that their product has been specifically developed for such an approach. What about RONOZYME® HiPhos? What is your counter-argument?

Although our research in DSM is unique to RONOZYME HiPhos, we have noted in the past that the extra-phosphoric effects of phytase do differ between phytases. These differences appear to relate to how quickly IP6 is degraded to IP4/3. A phytase which can rapidly degrade IP6 to at least IP4 is preferable to a phytase that does not prioritize the degradation of IP6 and is 'distracted' by other IP-esters. We do not believe it is necessary for an exogenous phytase to degrade IP6 to free myo-inositol as the mucosal phosphatases in the small intestine facilitate this process.
[Feedinfo News Service] Other companies argue that as a result of the increased bioefficacy of their phytase products, there generally isn't a need to resort to high phytase dosing when applying their products to animal diets. What is your opinion?

[David Nickell] That all depends on what benefits you are able demonstrate with a product. Overall, increased bio-efficacy of phytases is important, but how this is achieved differs per product. Optimal dose rates to capture feed costs savings as well as extra phosphoric effects have come down towards more economical levels. Where originally demonstration of extra phosphoric effects considered doses of many fold the practical levels, this is not the case anymore. We consider it our task as a phytase supplier to demonstrate for our product specifically the benefits it can generate and provide clear insights on the mechanism behind these in order to advice correctly on the application in practice. I can confidently say that as DSM we are in that position.

[Feedinfo News Service] Do you have any specific advice for nutritionists applying higher doses in practice?

[Neil Duijster] We see extra phosphoric effects most consistently at doses of 1500-2000FYT/kg. It is important to realize that the extra phosphoric effects result from a separate mechanism through myo-inositol. It improves nutrient deposition and not digestion. This means the effects occur in addition to the digestibility benefits we capture in our matrix value. We therefore advise to continue the use of our full matrix values for the relevant dose. If the formulation is set up in a flex-dose system that selects the right phytase inclusion based on cost savings, this will need to be changed and the dose fixed, for example, at 2000FYT level. As a last point: it is important that sufficient substrate is available for phytase when dosed at these levels. I always recommend adding phytate-phosphorus as a nutrient to raw material matrixes if possible, to ensure a good estimate of substrate levels in animal diets.