MICROBIOLOGICALS FOR DEACTIVATING MYCOTOXINS
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VICTAM ASIA/FIAAP PREVIEW
A selection of products on show
Technology focus: Expanding solution—Expansion helps solve raw material problems and minimize formula costs in a changing feedstuff market
FIAAP Conference presentation outlines and an introduction to the speakers

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ASIA’S FEED INDUSTRY SHOWPIECE GAINING MOMENTUM
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Above
Microbiologicals promise an effective way to deactivate mycotoxins

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Microbiologicals for deactivating mycotoxins

While widely used, mycotoxin binders have only limited efficacy, however microbiologicals are giving promising results

Inês Rodrigues and E.M. Binder

Mycotoxins are highly toxic secondary metabolic products of fungi mainly belonging to Fusarium, Aspergillus and Penicillium species. Under certain conditions these fungi produce mycotoxins, with the group of trichothecenes (e.g., deoxynivalenol, T-2 toxin), zearalenone, ochratoxins, aflatoxins and fumonisins being the most prevalent.

Mycotoxins are toxic to both humans and animals and since a large proportion of agricultural commodities are known to be annually affected by them, there is a great concern from the feed and food industries to prevent these toxins from entering the food chain. Several techniques have been developed and used throughout the years to avoid mould growth and mycotoxin production both in the field before harvest and during storage (Jouany, 2007). On the field level, crop rotation, tillage, weed and insect control, correct dates for planting and harvesting are some examples of prevention techniques which main objective is to avoid the manifestation of Fusarium sp. During harvest some factors such as the physiological stage of the plants, the harvester used, the humidity level (before and during storage) and temperature during storage should be controlled. From this point mainly the occurrence of the so-called storage mycotoxins (Aspergillus and Penicillium sp) should be avoided. As these prevention techniques act in a very limited way with unsatisfactory results, detoxification strategies had to
be, and have been, developed. These strategies can be grouped into three categories: physical, chemical and biological methods. Physical methods such as sorting, washing, de-hulling, thermal treatment, grain milling and irradiation and chemical methods; namely the use of acids, bases, oxidants and gases are inefficient, too costly and often destroy or remove essential nutrients from the feedstuff and reduce palatability. Biological methods comprise binding by adsorptive materials as well as microbial inactivation by specific microorganisms or enzymes. Various adsorbents are known to be commonly mixed into the feed in order to selectively bind mycotoxins in the gastrointestinal tract before reabsorption in the animal takes place. However, the adsorption of mycotoxins is only effective for aflatoxins as the presence of polarity in the mycotoxin molecule is a pre-requisite for successful binding. Therefore, biodegradation or biotransformation is seen as the only effective way to detoxify mycotoxins that can only be poorly bound by adsorbents, namely zearalenone, trichothecenes and ochratoxins.

Mycotoxin Toxicity
Different structures in each mycotoxin’s molecule are responsible for their toxicity. In the case of trichothecenes it is known that the removal of the 12-13 epoxide ring entails a great loss of toxicity. In the case of Ochratoxin A, cleavage of the phenylalanine moiety results in an isocumarin derivate ochratoxin alpha (OTa), 500 times less toxic than the original molecule.

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“...biodegradation or biotransformation is seen as the only effective way to detoxify mycotoxins that can only be poorly bound by adsorbents...”

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Figure 1 - Deoxynivalenol detoxification
Zearalenone has no acute toxicity associated. However, the high resemblance of this molecule with the female reproduction hormone – estrogen - misleads the cell-receptors, causing substantial fertility problems. For this mycotoxin, the detoxification strategy must include the destruction of the lactone ring so that it no longer causes estrogenic effects.

**Detoxification investigation**
Research in the field of mycotoxin detoxification is not a new issue – reports on this subject have been available in the past three decades. Based on the acknowledged higher resistance of ruminants to trichothecenes, Binder et al. (2000) were the first to isolate a pure bacterial strain from the bovine rumen fluid, *Eubacterium BBSH 797*. These microorganisms’ epoxidases were able to biotransform the epoxide group of

**Figure 2 - Ochratoxin detoxification**

**Figure 3 - Zearalenone detoxification**
trichothecenes (e.g. deoxynivalenol, DON) into a diene, thus converting these molecules into non-toxic metabolites (e.g. de-epoxy-deoxynivalenol, DOM-1). While investigating yeasts associated with termites and recognizing the ability of a particular yeast strain to assimilate inulin and galactitol, one new species of Trichosporon genus was found. The yeast strain isolated from the hindgut of lower termites – *Trichosporon mycotoxinivorans* - was found suitable to detoxify both ochratoxin A and zearalenone after incubation studies (Schatzmayr et al, 2006).

**Toxicity testing**

Toxicity tests were made to show that biotransformation of deoxynivalenol by *Eubacterium BBSH 797* as well as zearalenone and ochratoxin A by *Trichosporon mycotoxinivorans* (MTV) lead to metabolites that are non-toxic (Schatzmayr et al, 2006). In the case of DON a lymphocyte proliferation assay was used to prove that de-epoxy-deoxynivalenol (DOM-1) is significantly less toxic for lymphocytes from chicken than the parent compound DON (see figure 4).

At a DON concentration of 0.15 µg/ml the proliferation of lymphocytes was lower in comparison to the control (left “black” bar). After adding 0.3 µg/ml to the cells only one third of them could proliferate whereas at a concentration of 0.63 µg/ml DON the growth of the lymphocytes stopped. In case of the metabolite DOM-1 only a concentration of 116µg/ml completely inhibited the proliferation of the cells.

This test showed that the metabolization of trichothecenes by *Eubacterium BBSH 797* is a detoxification since the metabolite DOM-1 is 500 times less toxic than DON. These data are in accordance to that of Kollarczik *et al.* (1994) who used a MTT test to compare toxicity of DON and its metabolite DOM-1.

In the case of ochratoxin A, a macrophage activation test (MAT) was used for this purpose. In figure 5 the results of this test are shown. Production of NO is shown to be dependent of the concentration of OTA and its metabolite OTa. The production of NO is positively correlated with the growth of macrophages. It can be seen that in the concentration range between 0.741 to 2.222µg/mL OTA, growth of macrophages is depressed. At concentration levels higher than 6.667µg/mL it is completely inhibited. In contrast, the metabolite OTa seems to have no effect on macrophages’ growth at concentrations up to 20µg/mL.

![Figure 4 – LPA results of DON (left) and DOM-1 (right). DOM-1 is 500 times less toxic than DON.](image-url)
Similar results were obtained by Xiao et al. (1996) when the OTA and OTa toxicity was compared in prokaryotic and eukaryotic systems.

Finally for zearalenone, a bioassay was performed based on the knowledge that zearalenone stimulates the growth of a breast cancer cell line. The proliferation of these cells was quantified using a colorimetric assay. The increase in absorbance reflects the proliferation of the cells. As it can be seen in figure 6, the detoxified zearalenone sample did not increase the absorbance percentage in respect to control (I and II), thus it could be proven that the detoxification metabolite is no longer associated with the proliferation of breast cancer cells, as the original molecule, zearalenone.

Figure 5 - Results of MAT show that OTa did not inhibit growth of macrophages at a concentration level higher than 6.667μg/mL and can be considered as non-toxic.

Figure 6 - Absorbance % compared with control group. Detoxified ZON did not increase the absorbance %, indicating that no cell proliferation was observed.
“...the use of microbiologicals for deactivating mycotoxins seems to be the next step towards a successful mycotoxin counteraction in feedstuffs and animal feeds ...”

Microbiologicals for deactivating mycotoxins

*Eubacterium BBSH 797*, a bacterial strain isolated from the rumen of healthy bovines, has shown its capacity to successfully detoxify trichothecenes by removing the 12-13 epoxide ring, responsible for the toxicity of this group of mycotoxins. A yeast strain - *Trichosporon mycotoxinivoran* - was proven effective in the biotransformation of both ochratoxin A and zearalenone. The detoxification metabolites were subject to tests to verify their non-toxicity. As the detoxification techniques used up to now have shown to have limited effects, especially in the case of non-adsorbable mycotoxins such as trichothecenes, the use of microbiologicals for deactivating mycotoxins seems to be the next step towards a successful mycotoxin counteraction in feedstuffs and animal feeds; thus impeding these hazardous compounds from entering the food chain.

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The Gulf War was in full swing when Victam International launched its first show for the Asia Pacific region. Travel restrictions depleted the number of exhibitors who had booked space, and many of those who were able to attend had to contend with undelivered posters and equipment. International visitors were few on the ground but the regional feed industry came in sufficient numbers to encourage the organizers to persevere. From that inauspicious start, Victam Asia has grown into the most important event for the feed and grain industries in Asia Pacific bar none. And this year will be the biggest ever.

Asia’s feed industry showpiece gaining momentum

Since its first tentative debut in 1991, Victam Asia has grown to be the must do event for the Asia Pacific feed industry
Visitor pre-registrations have already surpassed previous total attendance numbers, the organizers said.
Victam Asia 2008 will comprise two side-by-side trade shows: Victam Asia and the new feed ingredient and additive exhibition, FIAAP.
More than 140 booths will exhibit products from feed ingredients and additives, to processing equipment, grain storage and handling, management software and more.
Four conferences will comprise the educational element of the event while exhibitors will also present their products in a series of technical seminars.
The Victam website provides details to all the information you could need to make the most of what promises to be the biggest and best Victam Asia yet.
General information about Bangkok and Thailand can be found on the Thai Tourism Authority website and details about the convention center are also available.
For your convenience, just click on the links on the right to take you directly to the information.
In our last issue we focused on aquafeed interests at Victam Asia/FIAAP; in this issue we present a small sample of some of the products on show for the animal feed and grain industries. We also give details of the FIAAP Conference.
VICTAM ASIA/FIAAP PREVIEW

Last month we brought you our picks for the aquafeed and petfood industry at Victam Asia and the new Feed Ingredients & Additives Asia Pacific (FIAAP) meeting. This month we turn our attention to animal feed and commodity handling and storage: we preview a selection of products on show and bring you details of the FIAAP Conference.

PREVIEW SELECTION
GRAIN STORAGE SILOS
Brock Grain Systems, marketed worldwide by Chore-Time Brock International, is a leading manufacturer and marketer of handling, conditioning, drying and storage systems for grain. At Victam Asia, the company will be promoting their line of hopper-bottom and flat-bottom commercial grain storage silos up to 32 meters in diameter and with a maximum single silo storage capacity of up to 24,000 cubic meters.
Brock also offers innovative enclosed roller-belt conveying systems capable of handling up to 500 metric tons per hour and silo sweeps with capacities ranging up to 1,600 metric tons per hour for the clean-out of flat-bottom grain silos.
DIRECT GEAR DRIVE BIN SWEEP
The GSI Commercial Direct Gear Drive Bin Sweep with reduction wheel is driven by the same motor that operates the unload auger, eliminating laborious removal and reinstallation of a typical bin sweep. All user operation of the system is performed outside the bin.
A solid steel clutch is enclosed in a separate chamber, keeping particulates from damaging the chain transmission. Double bearing square shaft removes unload auger engagement and alignment concerns. DuraEdge flighting is standard, on unload and sweep auger alike. Gates and control rods on intermediate wells come preassembled to the unload tube from the factory, for effortless installation and to ensure quality. Newly designed double rack and pinion well gate control operates the center, inside intermediate, and outside intermediate wells independently, and in the proper order.

BOLT ‘N’ GO
4B Braime will show its new revolutionary Bolt ‘N’ Go drop forged chain system. Unlike traditional systems which use welded flights, pins and circlips, that require the removal of the complete chain from the conveyor for repairs, the new Bolt ‘N’ Go system is a very flexible system of high strength hollow pins, heavy duty washers and nylock nuts, which enable bolts to pass through to connect the links together and attach flights. The system is easy, simple and reliable and reduces maintenance cost and down time dramatically.
Also on display: 4B’s range of steel and plastic elevator buckets and range of electronic elevator and conveyor monitoring equipment.
XTREME DUTY ELEVATOR BUCKETS
Tapco now offers a complete line of CC-XD (Xtreme Duty) elevator buckets designed for the most extreme throughput elevators. Injection molded with 35% more resins throughout the entire bucket – not just at critical wear points - guarantee very dense, long wearing surfaces. Strong, thick walls give and yield to withstand hangups and return to their original shape. CC-XD fills and discharges exactly the same as the tested and proven CC-HD style. All CC-XD buckets are 100% interchangeable with CC-HD buckets. Tapco buckets are stocked worldwide for prompt shipment. Available in Nylon, Polyurethane and Polyethylene.

CRUMBLER
Stolz will exhibit an original crumbler, Type PEDT 1800 that uses flour mill type cylinders with remote controlled gap adjustment in addition to the rollers alignment system, providing a top regular particle size range. It features a pneumatic bellows system that prevents damage to the rollers if hard foreign matter passes in between. The crumbler feeding system itself is achieved through a third cylinder providing an adjustable uniform layer over the entire length of the rollers. Designed up to 25 T/hr capacity, without affecting the final quality and particle size, it is equipped with an integrated bypass system in case of non crumbling and a sampling device.
ANALYSIS SOLUTIONS
Foss offers a range of feed, forage and grain analysis solutions: The InfraXact Pro, an easy-to-use and robust near infrared (NIR) analyser providing accurate results for key control parameters directly at the production line. RINA networking software for NIR instruments opens new opportunities for support and calibration management. Check your incoming grain at the weighbridge. Infratec is the most accurate grain protein tester in the world, delivering unsurpassed accuracy now with a 25% higher throughput. The Foss range of approved automated chemical analysis solutions that help to accelerate reference analysis operations and improve safety in the laboratory includes: Kjeltec, the first global standard with analytical and instrumental improvements of the Kjeldahl method. ISO 5983-2 for determination of nitrogen content and calculation of crude protein content and Soxtec for cereal products and animal feeding stuff. ISO 11805 for determination of crude fat and total fat content.

ACIDIFIERS AND PRESERVATIVES
Since taking over Verdugt in 2005, Kemira has become the single largest player world wide in feed acidifiers and preservatives. Kemira Specialty is the largest producer of calcium propionate in the world, both for feed and food use, as well as the 2nd largest producer of formic acid. Formic acid is an organic acid, widely used in the feed industry as an ingredient in Salmonella control agents and feed and drinking water acidifiers, because of its strong antibacterial mode of action. Besides these products, Kemira also produces and sells specialty products for dairy feeds, silage and crimping additives, as well as organic minerals, all based on organic acid salts. Kemira staff will be available at the booth to discuss the latest advances in market and product development coming from the European feed and farming market.
AQUAFEED.COM & LINX PUBLISHING
Now celebrating its 10th year, the Aquafeed.com web portal is the foremost aquafeed industry information resource. Aquafeed.com newsletters are published weekly in English and monthly in Spanish, for the Latin American market. It is also the organizer of the “Aquafeed Horizons” conference being held at the Bangkok show.
Linx Publishing, publishes Feed Technology Update electronic magazine, the only specialist publication focusing on new products and technology.
Along with Aquafeed.com, it is also co-organizer of the FIAAP 2008 conference –“Ingredients for Success”, also being held during the VICTAM and FIAAP exhibitions.
Linx also publishes FeedLink.com, the industry’s equipment and ingredients buyers’ guide – compare products by the leading industry suppliers – see photos and read the specs.
Come and visit us to find out more about any of our electronic products and to learn how our innovative publishing solutions can help your business.
Feed Management Systems, Inc. (FMS) is an award-winning software company providing integrated solutions for the global feed manufacturing industry to manage their nutrition, formulation and production needs. Real-time, integrated, scalable solutions include Feed Mill Manager, Brill Formulation, Feed Tags, and Feed Ration Balancer, and leverage the Microsoft technology you are familiar with today.

Feed Management Systems, software developer of Brill Formulation, announced the release of Version 2.0 in January 2008 to customers worldwide.

The widely adopted global feed formulation, nutrition and multi-blend software tool helps users manage nutrients, ingredients, costs and feed formulas.

With 50+ enhancements, users can gain even more efficiency by leveraging features such as SmartList reporting, the ability to run parametrics on ingredient value nutrients, rapid analysis of changes for purchasing decisions, and more.

This is the largest R&D investment ever made to this product line to date, and delivers as the leading software tool to help companies improve the efficiency and responsiveness in their ability to optimize and make on-demand ingredient purchasing decisions. The company invite visitors to Victam Asia to find out how FMS can help achieve higher margins at the lowest cost, by registering at www.feedsys.com/victam or at their booth.

If this were your advertisement it could reach more than 15,000 feed industry professionals. Contact us and we’ll tell you how.
E: info@linxpublishing.com or Ph: +44 (0) 1737 763501 (We’re nice people—we promise not to pressure you).
Expansion helps solve raw material problems and minimize formula costs in a changing feedstuff market

Worldwide the feedstuff market is undergoing a change: in particular, starch-containing raw materials such as maize and cereals have run short and are going up in price considerably. This is due to the increasing utilization of these components for the production of bioethanol as well as to the increasing production of feedstuff in East European and Asian countries.

Along with the production of bioethanol, Distillers Dried Grains with Solubles (DDGS) is produced, the residue of alcoholic fermentation, which is rich in protein and crude fibers.

Other high-fiber and high-protein by-products that are increasingly produced when rape seed is processed to biodiesel are rapeseed cake and rape extraction meal.

As a consequence of the shortage of cereals, other starch-containing and high energy raw materials are increasingly used in feedstuff formulae. Besides tapioca, these materials are mainly legume seeds.

Glycerol, which is produced in large amounts during the esterifica-
tion of oil to biodiesel, also plays an important role as a high energy substitute for starch.
Sugar is another possible energy carrier, which is an interesting alternative to starch, especially with regard to the price. Yet, there are limits to the use of all these raw materials in feed-stuff formulae: in DDGS the high content of crude fiber is the limiting factor, just as it is in rapeseed cake and rape extraction meal. In these rapeseed products as well as in legumes, the anti-nutritive factors (ANF) additionally act as limiting factors, so that hydrothermal treatment is required in order to eliminate them. A higher glycerol addition is detrimental to the pelletability and to the pellet quality: the rapid reabsorption of glycerol and sugar as well as the rapid availability of the energy, limit the levels that can be used in feed mixtures. In contrast, starch has to be enzymatically converted into sugar in the digestive tract first before it can be reabsorbed.
The optimization of the formula has always been a balancing act between cost optimization on the one hand and the requirements of animal nutrition on the other. The development of the costs for raw materials and their changing quality pose new challenges to the feedstuff producers, nowadays. What solutions are there?

EXPANDERS OFFER SOLUTION
The aim is to use the highest possible contents of economic and

Tons of distiller’s dried grains being held in storage at the ethanol plant in West Burlington, Iowa, USA. Photo: Steven Vaughn, USDA.
available raw materials in the formulae without the limiting factors of these raw materials being detrimental to the animals' health and performance.

It would be downright ideal if the limiting factors of feed components could be completely or at least partly eliminated during the production process. This would allow the use of higher contents of problematic raw materials in the formulae, the feed would become more economic and at the same time the risk of diseases and a reduced performance of the animal would be minimized.

The expansion of the feed makes it possible, and this is why more and more companies use the KAHL expander in order to achieve the following effect:

The expansion of the feed causes an increased digestibility of crude fiber. The percentage of high crude fiber components in feedstuff mixtures can be increased.

Anti-nutritive factors in legume seeds and rapeseed products are eliminated and no longer act as limiting factors in rapeseed expeller, full-fat soy and other legume seed.

By means of expansion a feed matrix is generated in which far greater quantities of fat and glycerol can be embedded than in un-expanded feed. The pelletability and pellet quality are maintained and the energy content of the feeds increases.

The modification of the feed due to expansion also causes the gelatinization of starch, which improves the digestibility of maize in particular. The feed has a higher content of metabolizable energy (ME).

Vice versa, by means of expansion, a certain energy level can be achieved in the feed even of only small percentages of expensive formulae components are used.

First research results also show that expansion has highly positive effects on the reabsorption rate of glycerol and sugar: obviously, more intensive expansion causes rapidly absorbable substrates such as glycerol and sugar to form a certain matrix structure with other feed components. Glycerol and sugar are released from this matrix with a delay.
Their release, however, lasts longer and thus takes place closer to the moment of protein digestion. This again improves the efficiency in the metabolization of proteins and amino acids and reduces the nitrogen emissions by the animals. The effects of expansion on the hygienic status of feed are generally known so that they shall not be explained in detail. In recent years, the design and the process technology of the expander have been significantly developed further. Apart from the proven "all-round" design with annular gap outlet, there are variants for special applications, for example in the oil milling industry, to achieve a particularly high starch modification of individual components, or simply for shaping of pasty products. Expanders with low-power motors with mixing section spare the pre-conditioners and provide a perfect hygienization of meal feed at high temperatures without over moistening it and thus reducing its pelletability. And meanwhile, the expander has set out to conquer also the food industry.
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Southeast Asia animal feed additives market: overview and trends

Sri Ganesh, Consulting Analyst, Chemicals Materials & Food, Frost & Sullivan Asia Pacific

An overview of animal feed additives in Southeast Asia in terms of market, size of unit, value and volume; pricing trends and the factors involved in influencing the prices of feed additives are also discussed.

The research presented includes feed amino acids, concentrating on methionine, lysine and tryptophan; feed acidifiers, and feed enzymes (non-starch polysaccharides and phytase).

These three categories were selected based on their current levels of significance in animal feed production in Southeast Asia. The presentation also covers feed antibiotics and direct-fed micro-bial products.
Challenges to this industry that are expected to have impact on the feed additive market will also be examined, such as strict regulation by the European Union, threat of diseases, low awareness about feed additives and cheap generic products. The geographical scope of this research in Southeast Asia, comprises Malaysia, Thailand, Indonesia, the Philippines and Vietnam. Poultry and swine sectors in all these countries are driving the growth in the livestock industry, although Thailand is the only country in Southeast Asia exporting poultry in large quantities to the European Union.

Supply and Demand of Raw Materials: Are they in balance?

Dr. Robert A. Swick, Agrenco Group, Singapore

Demand for biofuels has resulted in unprecedented demand for grain and oilseeds. Shortage in the supply of nutrients to feed ever more animals is a concern. Population increase together with higher income for food spending will increase demand on crop production. Large increases in production of grain and oilseeds are already taking place in the U.S., Brazil and Argentina, at the same time increased production efficiency is being made possible using transgenic varieties of crops. China has become the largest importer of soybeans. Prices will continue to increase and the feed industry will adopt new technologies to increase efficiency of nutrient utilization.

N.I.R.S technology will become more widely adopted as a way to rapidly measure energy and available amino acids in ingredients. Growth modelling will be used to better determine nutrient requirements. With better measurement techniques, identity preserved shipments of corn, soybean meal and other raw materials will be viewed and valued more as specialty ingredients and less as commodities. This paper will examine some of the supply and demand trends and technology affecting the global feed industry.

A comparison of digestible protein and amino acids content and value of terrestrial animal protein meals for aquafeeds

Dr. Yu Yu, National Renderers Association, Inc., Hong Kong

Protein and amino acids digestibility of poultry by-product meal, meat and bone meal, hydrolyzed feather meal, enzyme treated feather meal, blood meal, and red blood cells measured from several commercially important fish and shrimp will be presented. The respective digestible protein and AA content from these protein meals will be compared for matching the requirements of the aquatic species and the cost-effectiveness measured from growth performance and feed utilization. Special emphasis will be on high-value carnivorous fish and shrimp.
A Review of fish meal and fish oil in animal feed production
Scott Herbert, Omega Protein, USA
For many years fish meal and fish oil have served as a staple ingredient in feed for the animal and aquaculture industry. These ingredients have been targeted for replacement in feeds due to cost although they have been proven not be entirely irreplaceable. In more recent times concern has arisen that there will not be enough supply to cover the demand. The reality is they are simply moving to higher value markets and the use of complementary proteins and fats will be required.

The supply of fish meal and fish oil has remained stable for a number of years. Scott Herbert will cover these issues and more about fish meal and oil production and consumption.

Amino acid content in fishmeal shows high variation
Dr. Torben Gosvig Madsen, Regional Technical Service Manager, Degussa (SEA) Pte. Ltd.
During the last few years the price for fishmeal has more than doubled. This has increased the interest for alternatives to fishmeal. Fishmeal is however still used in many feed diets and one of the reasons is the good amino acid profile of the protein. Thus, it is important to look for amino acids when evaluating the quality of the fishmeal and not only crude protein level.

Degussa Feed Additives has analysed many fish meal samples from India and South America to give a better insight into the content of the first limiting amino acids; huge differences in crude protein content as well as in the amino acid profile were found. It is evident that the amino acid content is not a constant ratio of crude protein.

The variation will be reflected in the feed and the precise need for supplementation of the first limiting amino acids to meet the targets become more uncertain. The focus should be on the real content of amino acids in order to have the best information for purchasing decisions and feed optimization. This applies not only to fishmeal but also the other raw materials in the feed diet.
Natural Ingredients – Product Opportunities and Process Issues
Colin Mair, Cormar Technology Ltd., U.K.

All over the world we face increasing challenges to support the growth of aquaculture. One of these is the supply of the ingredients that provide our base protein and lipid requirements. The environment we work in becomes increasingly challenging and we are faced with increasing demands for ‘natural’, ‘sustainable’, ‘ethical’ and ‘organic’ products. These demands in turn are driving us to source naturally derived ingredients with, it is hoped, an optimized delivery of nutritional performance plus added health benefits.

It will be increasingly important to source ingredients that deliver the benefits of immune system stimulation, suppress autoimmune response, act as anti-bacterial and anti-viral agents, prevent or reduce cancers, deliver organically linked metals and pigments, and yet be sustainable, ethical and not create manufacturing problems.

This presentation will look at some of these novel ingredients, at the claims made for them and at the processing issues that may result from their inclusion in diets.

Mycotoxins in animal nutrition - problems and solutions
Mathieu Cortyl, Impextraco NV, Singapore Representative Office

Evaluating the economic impact of mycotoxins is not an easy task. In addition to symptoms that can be measured, such as reduction in feed intake, increase in feed conversion, slower growth, or impaired reproduction, mycotoxins affect the health status of the animals and also can reduce their immune defence.

The first way to avoid mycotoxin damage in animals is prevention, in the field or during storage; prevention does not remove existing mycotoxins however.

The efficacy of mycotoxin binders is limited to a few mycotoxins. Also, their efficacy in vitro does not guarantee their performance in vivo. Recent research indicates that the biotransformation of mycotoxins, using enzymatic preparations, gives promising results. Some enzymes can transform the structure of mycotoxins such as deoxynivalenol or zearalenone, which are very difficult to bind efficiently. The products obtained from the reaction are less toxic compounds.

Enzymes can have a specific action and their reaction, compared to binding, is not reversible.
Bacterial Contamination Of Feed And Feed Ingredients – Importance Of Control For Food Safety And Animal Performance

Adam Smith, Anitox Ltd, United Kingdom

The importance of controlling molds and mycotoxins in animal feed is widely known and practised, the importance of bacterial contamination and control is less well understood and frequently overlooked. This paper will examine the prevalence of bacteria in animal feedingstuffs and their significance in the safety of the food chain, animal health and performance.

The source, level and type of bacterial contamination of different feed ingredients types will be examined and the need for measures to control bacteria at all steps of feed processing highlighted. The potential for re-contamination during this process will also be discussed and the relative merits of the various chemical and physical control measures available for bacterial control reviewed, both from technological and economic perspectives.

The importance of feed as a vector for pathogenic bacteria will be quantified and their contribution to human food borne illness examined. The effect of high levels of bacteria on the form and functioning of the gastrointestinal tract and subsequent animal performance will also be discussed along with the economic benefits of bacterial control.

Efficacy of phytogenics in commercial Lohmann Brown layers

Robert Nichol1 and Tobias Steiner2, 1BIOMIN Singapore Pte Ltd, 2BIOMIN GmbH, Austria

The aim of the trial was to determine the benefits and economic advantages of a defined preparation of phytogenics in commercial layers in the early stages of the egg production cycle. Hens fed phytogenics consumed less feed and had higher egg production as compared to the control group. Total and average daily feed intake was lower by 1.8% when the control diet was supplemented with phytogenics.

Hens offered phytogenics produced more eggs and had a better feed conversion in comparison to birds in the control group. Additionally, supplementation of the diets with phytogenics improved egg shell parameters (Table 2), i.e. shell thickness ($P<0.05$) and albumen height. As indicated by a higher Hugh Unit rating (82 vs. 79), the internal egg quality was higher in hens fed phytogenics. Based on actual local prices, phytogenics successfully improved productivity in egg production, resulting in a 1.74% cost saving per egg (1.43 vs. 1.45 THB).
A specific fatty acid mix as sustainable alternative of antibiotic growth promoters in poultry nutrition
Joost Ameye, Vitamex Hong Kong
The ban in the EU on the use of all antibiotic growth promoters (AGP) in animal feeds results in important challenges for the European poultry producers. Poultry performance and feed efficiency are closely interrelated with the quantitative and qualitative microbial load of the host animal, including the load in the alimentary tract and in the environment.

The presentation investigates the potential of a specific fatty acid mix (alternative for AGP in poultry diets. The addition of specific fatty acids to poultry diets results in a stabilisation of the micro flora and prevents the development of pathogenic bacteria such as Clostridium perfringens and E.coli. Furthermore, the addition of the mix has a positive effect on the intestinal health and on the overall health status of the chicken, allows to control Salmonella and results in better technical performances.

A healthy gut for optimal performance through target release concepts in animal diets
Koen Schwarzer, NUTRI-AD International N.V.
Maintenance of a good symbiotic relationship between the host animal and its intestinal micro-flora is now recognized as a critical component in the development of good nutritional strategies. Implementation of a “prophylactic nutritional” program can assist in the maintenance of gut health and this is a better approach to optimization of genetic potential than the use of therapeutic substances to treat a metabolic malfunction.

To support the optimal functionality of the hint gut, of most vital importance, active principles have to be delivered where they have to function. Therefore an explicit production technique has been developed in which well-selected molecules, such as organic acids are encapsulated, resulting in a slow release of the active principles during transport through out the hint gut.

Different molecules are elected for particular functions; as energy source for the epithelial cells assuring nutrient absorption, as bacterial control to optimize intestinal micro-flora, to avoid adhesion of pathogens to the mucus, to avoid invasion of pathogens to reduce risk for incidence such as necrotic enteritis, colibacillosis, dysentery, dysbacteriosis,.

These target released concepts result in a healthier gut, improved performance in mono-gastric animals at an economic acceptable cost.
Fernando Rutz¹ and Andreas Kocher²  
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As a result of increasing demand on energy and protein sources for fuel production, the animal feed industry will be forced to have a close look at the viability of using by-products from the ethanol and biodiesel production. This presentation will examine ways to approach the energy crisis, such as breeding, feed formulation, physical feed structure, water restriction and thermoneutrality. Dr. Rutz will discuss in detail the use of a wide range of raw material and ways to improve their nutritive value using feed enzyme technologies. Lastly, the importance of ingredient analysis will be covered.
Aquafeed Horizons Asia 2008 will present the latest advances in aquaculture feed formulation and production technology and explore the trends and direction in which the industry is headed.

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