Sweating assets
Improving the performance of your aquafeed (or pet food) plant — By Colin Mair, Cormal Technology Ltd.

We continuously strive to improve the way that we manufacture products on extrusion plants, and equipment suppliers have incorporated many improvements to their equipment over the years. The learning experience is fragmented, however. The job of a manufacturing manager is to run the plant every day with minimum effort wasted on experiment.

Ewos Innovation invests in Ingot NIR Calibrations
Scientists at Near Infra Red calibration company Aunir have helped international aquafeed company EWOS implement NIR technology at its Innovation Centre at Dirdal, in southern Norway.

Utilization of acidifiers in tilapia nutrition and feeding
A short review on the use of potassium-diformate.

Advances in processing and formulation focus of meeting
Aquafeed Horizons Asia 2010 will focus on three key areas of concern for the aquafeed industries: protein, natural feed additives and processing efficiency.

New aquafeed plants
Skretting opens fish feed plant in Turkey; Cargill opens new aquaculture feed mill in Dong Thap, Vietnam.
We continuously strive to improve the way that we manufacture products on extrusion plants, and equipment suppliers have incorporated many improvements to their equipment over the years. The learning experience is fragmented, however. The job of a manufacturing manager is to run the plant every day with minimum effort wasted on experiment. Research centres tend to carry out short runs of product and don’t generally have long enough production time to accurately evaluate issues such as wear costs and energy costs. Good news does travel fast though, and innovations that give commercial advantage start to appear everywhere quite quickly.

Because of recent changes in the global financial climate there is more pressure than ever on manufacturers of extruded products to maximise production rates and minimise production costs on existing plant. This strategy of ‘Sweating Assets’ is best implemented if, before implementing the strategy, a clear picture of available technologies and techniques is viewed. The process can then be measured, key parameters benchmarked, then after this evaluation made of the possible ‘fixes’, including a cost/benefit analysis. The process of taking measurement before making changes is important, and this may involve using mobile instrumentation to, for example, measure exact energy profiles in drying systems. During the evaluation phase it may prove necessary to install permanent process instrumentation to measure performance on a continuous basis. It is Lord Kelvin who said, “Without measurement we know nothing”.

The following will detail in a very simple style the many ways of improving the manufacturing system, identifying the potential advantages to be gained in each case.

IDENTIFIED ADVANTAGES

A simple ‘Icon’ system is used throughout, as shown to the right:
GRINDING

A wide range of dry ingredients are used in most typical formulations. These ingredients vary in particle size, oil/fat content and fibre content, all of which affect the way the particles react in a milling system. The grinders used are generally hammer mills with swinging beaters hinged on a rotor, the tips of the beaters moving in close proximity to screens and serrated liners in the grinding chamber. It is difficult to reduce particle size from very large to very fine in a single pass, for instance whole grain maize going into a grinder with a 1.0mm screen. This tends to increase grinder motor load and increase temperature of the ground powder. Gradual reduction is best practice, with a pre-grind for large (cereal) ingredients, which also reduces segregation during storage and handling of mixed ingredients. After this first grind best practice is to mix the dry ingredients then go to second grind. Second grind may be one or two mills, with ideally sieve separation after each grind. This minimises energy costs and product temperatures after the grinders. For a really fine grind a pulverising mill may be required for the second grind. ‘High fibre’ ingredients, such as Sugar Beet Fibre, cause very rapid wear of beaters which quickly affects grinder performance. Controlled airflow through the grinder is important to prevent the grinder getting too hot. This can cause heat damage to the ingredients and can cause fat/oil to be separated from the ingredients, which causes ‘caking’ on the inner walls and the outside of the grinder screen, reducing grinding efficiency and in some cases requiring regular shut-down for cleaning. The following check-list highlights some of the issues.

Chart 1 - Grinder Check List

| Use beaters with tungsten carbide on facing edges | ☑️  ☑️  ☑️  ☐ |
| Keep grinder rotors, beaters, sweepers in balance | ☑️  ☑️  ☐  ☐ |
| Pre-grind coarse ingredients (cereals) | ☑️  ☑️  ☐  ☐ |
| Controlled negative airflow through grinder | ☑️  ☑️  ☐  ☐ |
| If using two grinders insert sieve between grinds | ☐  ☑️  ☑️  ☐ |
| Do not grind high oil/fat mixes until just before extrusion | ☑️  ☑️  ☑️  ☐ |
| Control moisture and density of cereal ingredients before grinding | ☐  ☑️  ☑️  ☐ |

PRE-CONDITIONING

The dry ingredients in the formulation are mixed with the wet ingredients and the mix is pre-heated before entering the extrusion system. This is all done in the pre-conditioner. The pre-conditioners normally used are always compromised. If all the particles aren’t evenly hydrated before addition of steam there is a differential or population effect. The average temperature may be as required, but a simple look at the material entering the extruder will soon show this problem, with some large, wet and fully cooked lumps being mixed with fine, dry, uncooked powder, with a range of particle sizes and moisture contents between the two extremes.

There are ways of improving performance without replacement or large investment in add-on equipment. The paddles of the conditioner can be reset for maximum fill and therefore maximum
residence time. This, however, can extend change-over time and increase change-over waste. The paddles can be reset so that they are not neutral, but either convey forward or backward under normal conditions. Set the whole so that the general direction of movement is to reverse flow and give good fill of the machine. Add to this an inverter drive that can be reversed at the end of a production run and more complete emptying can be achieved. In some companies, especially in Asia, some hydration water is added in a ‘second mixer’ before the conditioning system. This speeds up rate of hydration when the rest of the water is added in the pre-conditioner and can reduce extruder motor load by as much as 25%, or alternatively increase extruder production rates by as much as 25%. Little attention is paid to conditioning the steam injected into conditioners. If the steam carries a high and variable water load this reduces thermal transfer efficiencies and creates variability in machine and product performance. Simple addition of steam/water separators just before point of injection can greatly improve performance and product consistency.

Pre-conditioners are big lumps of steel and when started up from cold a large amount of steam can be used to warm up this steel, giving over-wet product with associated start-up waste. Use of various techniques to pre-heat the system can minimise this problem. Many companies still spray cold water into the pre-conditioners then inject steam to warm up this water as well as the other ingredients. Pre-heating the water makes rate of hydration more efficient, reduces energy costs and can take some load off the steam boiler where this is perhaps struggling to supply the plant. Water is still regularly added as a stream, not a fine spray, which again reduces efficiency and product consistency. Steam injectors plug (block) and often there is no way this is indicated. The use of misting plug-proof injectors with a simple way of monitoring that steam is flowing through the injectors fixes this problem. Volumetric feed systems create process and product variability that reduces efficiency and wastes ingredients. A retrofit of load cells and flow meters may not always be possible but there are big advantages to be gained by doing this. The following chart summarises these opportunities.

Chart 2 - Conditioner Check List

<table>
<thead>
<tr>
<th>Task</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add some water (5%) in a mixer before the pre-conditioner</td>
<td>![ ]</td>
</tr>
<tr>
<td>Condition steam before injection into pre-conditioner</td>
<td>![ ]</td>
</tr>
<tr>
<td>Meter dry ingredients into system using gravimetric (loss-in-weight) feeder</td>
<td>![ ]</td>
</tr>
<tr>
<td>Adjust paddle angle and speed to run conditioner as full as possible</td>
<td>![ ]</td>
</tr>
<tr>
<td>Use misting plug-proof steam injectors</td>
<td>![ ]</td>
</tr>
<tr>
<td>Use steam jacketed conveyor/conditioners after primary conditioner</td>
<td>![ ]</td>
</tr>
<tr>
<td>Control fill of conditioner with load cells and discharge metering device</td>
<td>![ ]</td>
</tr>
<tr>
<td>Use spray nozzles when adding liquids in conditioner</td>
<td>![ ]</td>
</tr>
<tr>
<td>Pre-heat water before addition in conditioner</td>
<td>![ ]</td>
</tr>
<tr>
<td>Use frequency inverter to control paddle speed in conditioner</td>
<td>![ ]</td>
</tr>
</tbody>
</table>
EXTRUSION

Up to now it may appear that making changes can improve production rates and energy costs to infinity. This of course is not the case. The changes make improvements where the particular process step is a bottleneck, and process evaluation needs to be made before implementing the changes.

Looking now at the extruder, a combination of thermal energy and mechanical energy is transferred to the mixed ingredients or extrudate. The thermal energy is transferred by the injection of steam through steam injectors. The point of injection has to be selected so that there is not too much back pressure from inside the extruder barrel and the injector design needs to be such that when there is no steam being injected the extrudate cannot plug the end of the injectors.

Mechanical energy is transferred to the extrudate mainly in the area where compression and backflow occur, usually at the end in a zone stretching back from the die. The parts wear more quickly in this zone, and as they wear this results in more inefficient pumping which can lead to surging and loss of production rates.

The barrels are usually cooled during running, and heated with steam before running. If a manifold and collection system is used that is too simplified this can result in waste of both the condensate when heating and the cooling water when cooling. Also, if steam traps are used on the outlet manifold in the simplified system, the steam traps can ‘lock’, resulting in a barrel overheating. The result is inefficient conveying, surging and lower production rates. Lower density ingredients can cause reduced production rates because at a fixed rotational speed the extruder is limited in its conveying capacity.

A lot of production runs are limited in length because cutter knives become blunt and need to be changed. Improving knife design and developing a way of very quickly shutting down and starting up increases average production capacity. Because of change-overs it is typical that process utilization is dropped by 25%, for example a 10 tonne per hour system running over a week at an average of 7.5 tonnes per hour. Channelling vented steam at the end of the extruder either back into the conditioner or downstream into the dryer improves energy costs and also reduces odour emissions.
The following chart summarises some of the possible improvements that can be made to the extruder.

### Chart 3 - Extruder Check List

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximise use of steam injectors in extruder barrel</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use frequency inverter to control screw speed</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Wear parts in work zone with tungsten carbide surface coating</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Rebuild wear parts in non-work zones using welding technique</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Install plug-proof misting steam injectors in barrel</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Condition steam before injection into barrel</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Change configuration, move work-zone forward &amp; reduce back-filling</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use mid-barrel die</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use venturi die at end of extruder</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Bush bearing to support extruder shaft inside barrel</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Shop around for replacement wear parts</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Recover heat on barrel cooling water e.g. pre-warm dryer make-up air</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Dry and re-use start-up and shut-down waste</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Transfer flash-off steam into conditioner or dryer</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use hard wearing, disposable ‘sacrificial’ knives</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Have duplicate knife holder fastened to die for next production run</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Rebuild exit manifolds from barrel to recover condensate and water</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use gravimetric dry feed system and proportional control of fluids</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Pre-heat water added in extruder barrel</td>
<td>![Status Icon]</td>
</tr>
<tr>
<td>Use steam flow sensors on steam injectors</td>
<td>![Status Icon]</td>
</tr>
</tbody>
</table>
Drying

The dryer is the biggest single energy user in the plant, and represents the biggest potential for improvement in costs. The two types of dryer usually found are horizontal conveyor dryers and vertical counter-flow batch dryers. This article does not look at the comparative merits of the different dryer designs. It simply looks at ways of monitoring and improving performance of existing dryers, which in most cases means conveyor dryers.

Most dryers use a principle of recirculating air through the bed of product, bleeding off some air into the exhaust air stream after it has passed through the product bed(s), then adding fresh ‘make-up’ air before reheating the mixed air stream, which then passes through the product beds. This principle of operation allows the recirculating air stream to build up absolute humidity, which greatly increases the enthalpy or energy of the recirculating air at any one temperature. Some of the tips on the following chart increase both humidity and temperature of the make-up air, which has a significant effect on energy savings.

Changes in production rate require the dryer to be rebalanced to optimise energy and moisture control, which is very difficult if the process relies on manual operator input. Start-up and shut-down also create the problem of overdried product if the system relies on manual operator input.

Variable moisture or wide moisture ‘bandwidth’ also result in losses because the operator usually runs at a lower mean moisture level to ensure that all product is below specified moisture level. Note that a consequence of wide moisture bandwidth is that the dryer particles break easily, causing increased fines production as dry product is conveyed and processed. This effectively reduces production capacity and energy costs. Odour emission is becoming an increasingly pressing issue, and clever recycling of other airstreams into the dryer reduces the number of air streams that need to pass through odour control systems at the same time as reducing dryer energy costs.
Coaters may be continuous, usually in the form of rotating drums, or batch, these being adapted mixers which may also have vacuum coating ability. Coating is a misnomer, as for most products it is required that most of the coating liquids are actually infused into the centre of the product piece. If the coating liquids include a fat that is solid at room temperature it is better if both the product and the fat are at elevated temperature. This prevents the fat hardening on the surface of the product and also increases rate of diffusion of the fat into the centre of the product. Pet foods usually have multiple coating systems applied, with fat followed by digest, either liquid or powder. Liquid digest is aqueous, which means care must be taken to apply in sequence with the fat. In a vacuum coater the level of vacuum is adjusted to achieve optimum fat penetration, at the same time leaving just enough fat on the surface of the product to give it a ‘glaze’. Coating ingredients are expensive and the application and handling systems must be designed to prevent waste. It is the coating system in pet food that largely determines the palatability of the pet food.

<table>
<thead>
<tr>
<th>Chart 4 - Dryer Check List Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure spread of product onto dryer beds is level</td>
</tr>
<tr>
<td>Metering system for heater energy inputs into dryer</td>
</tr>
<tr>
<td>Channel exhaust air from cooler as make-up air into dryer</td>
</tr>
<tr>
<td>Install motorised air-flow control valves on exhaust air system</td>
</tr>
<tr>
<td>Use moisture and feed rate measurement into dryer</td>
</tr>
<tr>
<td>Absolute humidity meter on exhaust air stream</td>
</tr>
<tr>
<td>Frequency inverters or motorised valves on recirculation fans</td>
</tr>
<tr>
<td>Replace steam heat exchangers with gas burners</td>
</tr>
<tr>
<td>Replace solid steel trays with woven mesh belt</td>
</tr>
<tr>
<td>Install internal baffle plates to control airflow through beds</td>
</tr>
<tr>
<td>Inject humidity and/or steam into dryer</td>
</tr>
<tr>
<td>For larger products redesign shape and/or use docking holes</td>
</tr>
<tr>
<td>Monitor and control bed depth</td>
</tr>
<tr>
<td>Control system to ramp up and down during fill and empty</td>
</tr>
<tr>
<td>Where required use low energy odor control system on dryer exhaust</td>
</tr>
</tbody>
</table>
If the ingredients are mis-handled, for instance having a fat system that ‘burns’ the fat and allows development of rancidity, then palatability will be reduced. If the pieces of product are not evenly coated then again palatability will be affected. This can happen, for instance, in a vacuum coater with low profile, where even addition of powder can be a problem. Batch mixers damage product, creating ‘fines’ that are ten sieved out before packaging. Over-dried pieces break easily, either by direct metal to product attrition, or by product to product attrition, or by crushing in the mixer. Hot product is less friable than cold product, reducing breakage in the coater. Larger product pieces have a lower surface area to volume ratio which affects coating performance. Varying levels of vacuum applied can adjust this problem. Vitreous products and those with a simple cell structure are more difficult to coat than less vitreous products with a more complex cell structure, so product structure needs to be controlled to optimize both mouth ‘bite’ and coating performance.

**Chart 5 - Coater Check List**

**COOLING**

<table>
<thead>
<tr>
<th>Condition / Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>High product temperature into coater</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Optimise coater fill levels</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Optimise liquid spray system</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Control rotational speed</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Control level of vacuum applied for each product</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Adjust paddle design if breakage high</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Control cell structure and vitreous characteristic of product</td>
<td>![Checkmark]</td>
</tr>
<tr>
<td>Use good powder sprinkler bar to coat evenly</td>
<td>![Checkmark]</td>
</tr>
</tbody>
</table>

Product should be controlled to a temperature within 5 degrees C of ambient temperature immediately after the dryer to prevent condensation and mould growth. This should not be process plant ambient, but should be ambient temperature of the warehouse the product is to be stored in. Larger product pieces need a longer residence time in the cooler to ensure the centre of the product is cooled. Higher production rates need longer residence time in the cooler, which also means the air flow levels through the cooler should be higher. Note that some water is removed from the product in the cooler and this should be measured and then taken into account when controlling the dryer.

Even though the cooler exhaust air may not appear to be very warm, the slightly elevated temperature plus the elevated humidity caused by the drying effect means that the air carries significant energy, and should be routed into the dryer as make-up air. This also reduces one of the sources of odour emission, simplifying any odour reduction systems that may need to be installed.
SUMMARY

The production rate should be limited only by the production capacity of the extruder, this being limited by the conveying capacity of the machine. Wherever possible steam should be used to maximise production on the extruder and at the same time minimise extruder motor load and wear costs. An achievable target is a Specific Mechanical Energy (SME) of 19 kWh/tonne of dry product. Energy costs should be minimised, aiming for 5% steam injection in the conditioner and 2% steam injection in the extruder. Achievable energy target costs for the dryer are 2,400 kilojoules per kg of water evaporated. For a product entering the dryer at 23% moisture content and leaving the dryer at 8% moisture content this is 476,610 kJ/tonne dry product or 130 kWh/tonne. Moisture bandwidth can be reduced to below ±0.75% and product breakage (fines) can be reduced to below 1%. Plant utilisation rates of at least 80% should be the target. Total production costs (not including ingredients or packaging costs) approaching $100/tonne are achievable. Sweating assets is not just good manufacturing practice, it is now becoming a survival strategy.

When looking at future process expansions simple capital cost is not the only number to be considered. Running costs should be also considered over the same time period that the capital equipment is depreciated, and the supplier of equipment should be able to give information that allows this analysis. Process design should also consider running costs. For example, if an airlift is used to convey product from the extruder to the dryer this will cost at least as much as the wages of a process operator. The air volume will be so high it cannot be reused and will then create an extra source of odour emission. A steel frame to elevate the extruder above the dryer may look more expensive initially but will pay back very quickly. The discipline of sweating assets thus creates the secondary advantage of creating a ‘lean green’ specification for new expansion projects.

For more information, please contact Colin Mair or visit the Cormal Technology website.
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Routine use of antibiotics as growth promoters is a matter of debate in the animal farming industry. The use of low levels of these antibiotics in animal feeds potentially can transfer bacterial immunity to species pathogenic in animals and humans (Liem 2004). The EU has banned all antibiotic growth promoters (AGP) from livestock production with effect January 2006. Public opinion and regulating authorities in most export countries are focusing now on the misuse of antibiotics in aquaculture and public attention has shifted towards production methods. Therefore, alternatives to AGP are being sought worldwide in a variety of forms. Acidifiers consisting of organic acids and their salts present a promising alternative and they have received much attention as a potential replacement to improve the performance and the health of treated animals. In animal nutrition, acidifiers exert their effects on performance via three different ways (Freitag 2007): (a) in the feed; (b) in the gastro-intestinal tract of the animal; and (c) due to effects on the animal’s metabolism.

The beneficial effects of acid preserved products caught the attention of the scientific community, prompting the investigation of the effects of these short-chain acids when applied directly to fish feeds. In recent years the use of acidifiers in fish nutrition has become more popular (see the review paper – Lückstädt 2008). In particular, several studies have been conducted with potassium-diformate (a double-salt of formic acid) in herbivorous filter feeders, like tilapia.

Ramli et al. (2005) tested potassium diformate (potassium salt of formic acid) as a growth promoter in tilapia grow-out in Indonesia (Table 1). In this study, fish were fed over a period of 85 days, six times a day diets containing different concentrations of potassium diformate (0%, 0.2%, 0.3% and 0.5%). The diets contained 32% crude protein, 25% carbohydrates, 6% lipids and 10% fibre. The fish were challenged orally starting day 10 of the culture period with Vibrio anguillarum at 10⁵ CFU per day over a period of 20 days.
Table 1: Effects of potassium diformate supplementation in diets on performance of tilapia challenged with *V. anguillarum* (modified from Ramli et al. 2005)

<table>
<thead>
<tr>
<th>Potassium diformate inclusion in diet (%)</th>
<th>0</th>
<th>0.2</th>
<th>0.3</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (g)</td>
<td>16.7</td>
<td>16.7</td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Final weight (g)</td>
<td>218&lt;sup&gt;a&lt;/sup&gt;</td>
<td>258&lt;sup&gt;c&lt;/sup&gt;</td>
<td>246&lt;sup&gt;b&lt;/sup&gt;</td>
<td>252&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>FCR</td>
<td>1.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.25&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.22&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mortality (%), day 10-85</td>
<td>33.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11.0&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>abc</sup>within rows, means without common superscripts are significantly different (p<0.05)

Over the entire feeding period from day 1 to 85, potassium diformate significantly increased feed intake (P<0.01) and weight gain (P<0.01) as well as improved the feed conversion ratio significantly (P<0.01). Furthermore, protein efficiency ratio was also significantly improved due to the addition of the formic acid salt (P<0.05). The improvement was best with 0.2% and 0.5% addition of the formate. Survival rates of fish after the challenge with *V. anguillarum* on day 10 were also significantly higher compared to the negative control and the effect was dose dependent (P<0.01). The authors concluded that the application of potassium diformate at 0.2% is an efficient tool to control bacterial infections in tropical tilapia culture.

Similar results were achieved by Zhou et al. (2008), who tested hybrid tilapia (*Oreochromis niloticus* x *Oreochromis aureus*) fingerlings (2.7 g initial weight) in a dose response study with potassium diformate (0%, 0.3%, 0.6%, 0.9% and 1.2%), while also comparing the results with an antibiotic growth promoter (8 mg / kg Flavomycin). During the 56 day trial period, tilapia fed all the potassium diformate enriched diets grew faster than the negative control (an increase of up to 11.6%), while fish fed 0.3% and 0.6% potassium diformate achieved even better weight gain than the fish in the positive control group. The authors speculated that dietary potassium diformate could stimulate a beneficial bacterial colonization of the intestine.

The latest study with this highly effective substance was carried out in Malaysia (ng et al. 2009). There, a 14-week feeding trial was conducted to determine the effect of dietary organic acids. The experimental diet was added with 0.2% of potassium diformate and fed to triplicate groups of red hybrid tilapia. Upon completion, tilapias were challenged with *Streptococcus agalactiae*. 
Results clearly showed that total bacteria per gram of faeces were significantly reduced in diets containing potassium diformate. The number of adherent gut bacteria tended to be lower as well. Furthermore, apparent digestibility of phosphorous was improved too - by nearly 11% in acidified diets. Finally, cumulative mortality of fish fed no organic acids (58.3%) was higher compared with fish fed the potassium diformate supplemented diet (16.6%) at 16 days post challenge.

The Malaysian data showed that the inclusion of this acidifier can exert strong antimicrobial effects and have the potential to exert beneficial effects on nutrient utilization as well as disease resistance in tilapia. Organic acid salt may be therefore of high importance for tilapia culture (Lückstädt 2008) especially during the grow-out period. Though there are only a limited number of published studies on the use of acidifiers for growth promotion, feed efficiency as well as mineral absorption and disease prevention in tropical finfish aquaculture, results from those studies indicate promising potential and compel aqua feed manufacturers to consider using acidifiers in their diets. The use of acidifiers, especially of potassium diformate in tilapia, can be therefore an efficient tool to achieve sustainable, economical, and safe fish production (Lückstädt 2007).

For more information or to obtain literature references, please contact the author: Christian Lückstaedt. Visit the Addcon website.
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Scientists at Near Infra Red (NIR) calibration company Aunir have helped international aquafeed company EWOS implement NIR technology at its Innovation Centre at Dirdal, in southern Norway. Aunir’s INGOT calibrations for analyses of moisture, protein, fat, fibre and ash, are being validated at the Innovation Centre ready for implementation at its Norwegian production facilities. Aunir is also helping the Innovation Centre to extend the use of NIR to profile fish growth from novel fish diets.

EWOS, which globally manufactures one million tonnes of high value salmon feed a year, chose to invest in Aunir’s aquafeed calibrations to give them better control of incoming raw materials, process control and final product quality.
Aunir is based in the UK, and is a division of AB Agri, an international animal feed business. Aunir develops and supplies INGOT calibrations, SPECMAN Gold quality control software and NIR support contracts and consultancy to a wide range of agri-food industries world-wide. The company currently supports more than 200 NIR users in over 40 countries. The complete INGOT feed and feed ingredients database contains data derived from the analysis of more than 120,000 samples over the past 20 years, and is the most extensive database of its kind in the world.

The aquafeed NIR calibration database contains dried feed and ingredients which have been sourced from many different geographical regions, and include samples with a wide range of seasonal, varietal and feed formulation characteristics. The INGOT calibrations are applicable for the analysis of both fresh and salt water aquafeed, and compatible with all types of NIR spectrometer. The databases are constantly being updated with new data from around the world.

“Aquatic species require feed formulations high in protein,” says Chris Woodley, NIR technical support manager at Aunir.

“Up to now mainly animal and marine meals have been used. However, economic pressures are now encouraging manufacturers to investigate the use of alternative sources of protein, including those derived from plants.

“We are currently helping aquafeed companies assess the nutritional constituents of a wide range of new potential feed ingredients.”

NIR is a proven technique for the rapid multi-component analysis of bulk materials with little or no sample preparation. It identifies molecules in an organic material by analysing the vibrations of their constituent bonds. When irradiated with energy, each chemical bond in the molecule vibrates at a frequency which is characteristic of that bond. These vibrations can be accurately related to nutritional, chemical and physical properties.

The process is quick, easy and non-destructive, and does not require the use of hazardous chemicals or time-consuming laboratory techniques. Testing can be carried out by non-technical staff. NIR can reduce the cost of nutritional testing without compromising analytical accuracy and precision. The integration of NIR technology into any manufacturing business can yield significant costs savings through:

- Better understanding of raw material quality against agreed purchasing contracts
- Tighter process control during manufacture, reducing the risk of reworked or scrapped product
- Final product testing to ensure delivery of products of consistent quality to customers
- Reduction in the cost of testing via traditional wet chemistry techniques.

“In most cases, savings made by reducing external wet chemistry analysis can pay back the NIR capital investment within 12 to 18 months,” says Mr Woodley. “This is a key driver for businesses moving to NIR.”

“However, the calibrations are the key to successful NIR analysis. They are at the heart of any NIR instrument, and ensure that the results are valid, true and meaningful.”
Feed ingredients, by their very nature, will always vary in their chemical and physical composition, between seasons, years, suppliers and even loads. INGOT calibrations are updated annually and take into account the huge potential variation in the parameters under investigation.

Aquafeed manufacturers and their suppliers need to constantly monitor the quality of both the raw material ingredients and the finished feeds, to ensure that they are buying and producing quality products. Also having knowledge about the ingredients allows them to take advantage of price differentials without compromising quality.

“Due to the success of the INGOT calibrations, scientists at the EWOS Innovation Centre are now working closely with us to expand the use of NIR - developing calibrations for the analysis of fatty acid profiles in marine oils, vegetable oils and fish flesh, and carotenoid pigments such as Astaxanthin within finished feed and fish flesh,” adds Mr Woodley.

“It is really pleasing to see that with Aunir’s assistance, NIR has become an integral part of this leading aquafeed business.”

For more information please contact Aunir, Ph: +44 (0) 1327 810910 or visit Aunir’s website
Dr. Juadee Pongmaneerat, Senior Expert in Fishery Product and Inspection, Thai Department of Fisheries, will once again set the scene for the 4th Aquafeed Horizons Conference, which will take place on March 3, 2010, the opening day of Victam Asia 2010. The meeting will focus on three key areas of concern for the aquafeed industries: protein, natural feed additives and processing efficiency.

PROTEIN SOURCES

Fishmeal and fish oil are always at the top of the list of concerns for aquafeed manufacturers. Two of the most important issues are sustainability of the fisheries that provide the raw material and the purity of the products arriving at the feed mills. Dr. Andrew Jackson, Technical Director, International Fishmeal and Fish Oil Organisation, U.K. will discuss both developed third-party audited schemes and those in the process of development, including the new IFFO Global Responsible Supply Standard, as a means of providing assurance to the value chain.

Approximately 12.5 million tonnes of rendered animal meals are available globally, roughly twice as much as fishmeal. Dr. Geoff Allan, N.S.W. Department of Primary Industries, Port Stephens Fisheries Centre, Nelson Bay, Australia, will present data for digestibility and utilization of rendered animal products fed to a variety of carnivorous and omnivorous aquaculture species, including carnivorous marine finfish. He will argue that substantial replacement of fishmeal is possible, particularly with blends of alternative protein sources based on rendered animal meals.

Considerable effort has also been expended to assess and develop a range of grain protein meals as alternatives to fishmeal. However, the evaluation of such feed ingredients is crucial to their effective application in diets for aquaculture species. David Smith, Food Futures Flagship - CSIRO Marine and Atmospheric Research, Australia, will explain that while there is no single ideal alternative, many of the different feed grain resources offer sound potential when used in the right application. Indeed the judicious use of certain feed grain resources can confer significant nutritional and technical advantages to the feed design and management process.
NATURAL FEED ADDITIVES

The active search for natural growth promoters is starting to extend from animal feed into aquafeeds, as consumer pressure is likely to ban antibiotics from production in most countries. Although the screening of these compounds for aquaculture has just started, promising results have been obtained with different species. Dr. Peter Coutteau, Business Development Manager Aquaculture, INVE Nutri-Ad, Belegium will illustrate the development of a number of innovative feed additives to optimize the utilization efficiency of nutrients from traditional ingredients for aquaculture species.

PROCESSING TRENDS AND SOLUTIONS

Changes throughout the entire aquafeed value chain will impact feed millers in the near future and beyond. Urs Wuest, Head of Engineering & Fulfillment at Buhler, will discuss the current trends in the aquafeed industry in South East Asia and China, including raw materials, feed manufacturing, aquaculture, crustacean and fish processing and the demand from customers - in total, and by fish.
species. He will explain how changing requirements in the aquafeed industry translate into a demand for specific technical requirements, such as extrusion technology.

Many trends affect plant efficiencies, in particular energy usage and product safety. Galen Rokey, Manager, Process Technology, Wenger Mfg., Inc., Kansas, USA, will take a look at several specific areas that favorably affect plant efficiency and can easily be implemented, such as adjusting the process to use least cost energy source, tightening product moisture variation off the dryer, recycling under-processed material, extended service programs and line audits and on-line monitoring and control.

When reviewing the total cost of production for a specific type of feed, the raw material cost is typically in the range of 80 to 90%. Needless to say, a 10% savings on the raw materials will have a greater impact on production cost efficiency than most likely anywhere else in the process.

William Henry, Director of Technology and Research & Development, Extru-Tech, USA will address the strategy of increasing the process ingredient flexibility from two primary angles: changes and enhancements in the core pieces of equipment in a typical extrusion process and secondly, a review of proper process management directives.

Finally, production methods for manufacturing starter feeds and shrimp feeds will be examined by Joseph Kearns, Aquaculture Process Technology Manager, Wenger Manufacturing, USA. Extrusion cooking in various formats will be discussed with the technology involved for production of these feeds and also the ability to produce at increased production rates of up to three to five times the standard range while allowing all the formulation advantages seen in extrusion of shrimp feeds.

REGISTRATION & MORE INFORMATION

Aquafeed Horizons Asia Conference takes place March 3, 2010 at the QSNCC, Bangkok, during Victam Asia 2010. Pre-registration is required for this conference and limited-time, discounted “early bird” bookings are already underway.

To secure your place, register online at: www.feedconferences.com.

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PROGRAM

Welcome and introductory presentation
Dr. Juadee Pongmaneerat, Thai Department of Fisheries, Bangkok, Thailand

Reassuring the value-chain as to the sustainability and purity of fishmeal and fish oil
Dr. Andrew Jackson, International Fishmeal and Fish Oil Organisation, U.K.

Rendered products in aquafeeds
Dr. Geoff Allan, Port Stephens Fisheries Institute, ACIAR Fisheries Program Consultant, Australia

Harvesting the benefits of grain application in aquafeeds
David Smith/Dr. Brett Glencross, CSIRO Marine and Atmospheric Research, Australia

Stabilizing formulation cost and performance of aquafeeds require innovative approaches
Dr. Peter Coutteau, INVE Nutri-Ad, Belgium

Trends in aquafeed in South East Asia and China: relevance and technical solutions
Urs Wuest, Buhler, Switzerland

Increasing the ingredient possibilities for floating feeds
Will Henry, Extru-Tech, USA

Improving plant efficiencies
Galen Rokey, Wenger Manufacturing, USA

 Extrusion of micro aquatic and shrimp feeds
Joe Kearns, Wenger Manufacturing, USA

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Presentation outlines, updates & more...

http://aquafeedconferences.blogspot.com

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Skretting opens fish feed plant in Turkey

Skretting officially opened a new feed production plant in Güllük to serve the expanding Turkish aquaculture market. Executive Vice President of the Skretting Group Knut Nesse joined Güllük Mayor Aytunc Kayrakci, for the ribbon-cutting ceremony followed by a plant tour and reception.

Constructed on the site of an existing Skretting warehouse, the plant will produce feeds for freshwater trout and marine species such as sea bream and sea bass. Most of the output is for domestic sales but some will be exported. “Turkey has a well-established aquaculture industry and Skretting has a long history of supplying it with feed,” said Alberto Allodi, Managing Director of Skretting East Mediterranean. “That is why we already had a warehouse in Güllük. As the market expanded we realized a local plant would benefit fish farmers in Turkey and demonstrate our commitment to Turkish aquaculture.”

“We are starting production with one extruder line, newly-built to meet latest standards. Using quality raw materials and established Skretting formulations, we will provide feeds that match the high nutritional and physical quality our customers expect from Skretting. I have no doubt we will expand our market share. A modular design for the plant means infrastructure is in place to add second and third extruder lines quickly as demand increases,” said Levent Kayi, General Manager of Skretting Turkey.

Raw material supplies combine the benefits of local sourcing with the international procurement expertise and power of the global Skretting organisation. This applies both to the marine raw materials, where Turkey has a small but high quality production, and vegetable raw materials. Additionally, the micro ingredients come from sister Nutreco company, Trouw Nutrition Turkey.
Located in Güllük, in the Bodrum area, the plant is well positioned to supply the main trout and marine producers. Being just seven kilometres from the port of Güllük simplifies shipping of raw materials to the plant. Additionally, Güllük is only 200 kilometres from one of Turkey’s largest ports at Izmir. Finally, it is close to the local airport.”

Giovanni Serrini, Commercial Director of Skretting East Mediterranean: “There are interesting aquaculture developments in many neighbouring countries. If we add the population of Turkey to those of the neighbouring countries and some potential markets in the Middle East, the plant can serve aquaculture production for over 250 million people. Most of these are in emerging economies, which means demand will expand rapidly once we are past the current economic crisis. I am confident we will be installing the second line in the foreseeable future.”

Alberto Allodi adds, “Current economic events have impacted the markets since we took the decision to build the plant but we still have a firm belief in the long-term success of aquaculture in Turkey and in the surrounding areas. Turkey is already one of the leading aquaculture producers in Europe. It has excellent production conditions with real potential to grow and that is supported by strong domestic consumption. Aquaculture and the consumption of fish in this region are set to grow substantially.”

Cargill opens new aquaculture feed mill in Dong Thap, Vietnam

Cargill Animal Nutrition announced the opening of its new aquaculture feed mill in the Mekong Delta province of Dong Thap. This is Cargill’s sixth feed mill in Vietnam.

“This new investment demonstrates Cargill’s commitment to serving Vietnamese livestock and aquaculture growers,” said Stoney Su, general manager for Cargill Animal Nutrition-Vietnam.

The mill is designed to have an annual capacity of 60,000 tons of aquaculture feed, which will give Cargill-Vietnam a total production capacity of 720,000 metric tons per year. The new Dong Thap aquaculture feed mill will complement Cargill’s other feed mills located in Can Tho, Dong Nai, Binh Dinh, Long An and Hung Yen.

“Cargill is committed to the development of Vietnam’s livestock and aquaculture industry,” Su added. “In these uncertain times, our customers are looking for reliability. Cargill will be part of their solution. The new Dong Thap plant will allow Cargill to more effectively deliver the best and latest feed technologies and services to our local dealers and aquaculture growers throughout the Mekong Delta.”

Cargill has approximately 560 employees in Vietnam and has been in the Vietnamese market for over 12 years. The company has received numerous recognitions for its business and philanthropic activities by both Vietnamese and U.S. organizations, including: the U.S. Department of State’s “Corporate Excellence” award; the Saigon Times’ “Top 40” award recognizing international companies in 2005, 2006 and 2008; the “Golden Dragon Award” in 2006 and 2007; and the “Educational Promoting Award” in 2007.
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