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The holistic approach to automation and moisture control technology in aquafeed mills

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The holistic approach to automation and moisture control technology in aquafeed mills

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In a recent paper that appeared in the September-October 2013 issue of our sister publication, Grain & Feed Milling Technology magazine, we highlighted the challenges facing feedmills in terms of direct losses associated with moisture and product waste, and the new technologies that provide direct solutions to these problems. Our attention now turns to aqua feedmills, where although the process flow is similar there are unique differences, particularly relating to physical quality parameters and the impact of drying product that make the utilisation of these new technologies even more exciting.

In the many world regions, many companies still rely heavily on bags and less on bulk for the receiving of ingredients. In either case it is common to see numerous trucks lined up either inside or outside the mill waiting to unload. This creates a number of challenges in terms of maintaining control of trucks and personnel while on site and ensuring the correct quantity and type of product are unloaded.

Manual systems that rely on paperwork are prone to human error.

To counter this, automation systems, such as the ones developed by Agentis Innovations, can replace the paperwork and ensure the movement of trucks and ingredients to the correct location for discharge as well as provide for accurate stock inventory and provide traceability.

Raw material unloading

Control of the unloading of raw materials is important to avoid errors and waste.

For bulk or liquid container intakes errors can result in expensive losses due to incorrect manual silo selection or failure to recognise a silo is full. This represents both financial loss as well as nutritional loss due to mixing of different types of ingredients. Programmable Logic Control Units (PLC) in conjunction with adequate and appropriate instrumentation and software can eliminate this type of error through automatic route control and high level silo indicators to show when silos are full.

Technology also provides sophisticated bag counters on the unloading conveyors which provide accurate real time stock inventory.

Bag unloading can be insecure or inaccurate in terms of ensuring the correct number of bags are unloaded at the correct point. Technology now provides sophisticated bag counters on the unloading conveyors which are difficult to de-fraud and again provide real time stock inventory.

Grain silos and drying

Often the quantity of grains is discharged into and out of the silos is not known accurately due to the lack of a weigh scale hopper or in-flight conveyor weighing systems resulting in inaccurate stock reconciliation when transferred to the mill.

The most common causes of loss are either wastage due to poor silo management or losses resulting from moisture shrinkage. It is not uncommon to hear of significant volumes of grains being disposed of because they are unfit for purpose when emptying the silos.

The other risk is the deterioration due to mycotoxin/bacterial contamination that often occurs due to long-term storage and which can result in significant nutritional losses.

New sensor technology, pioneered by Agentis Innovations for example, is being deployed to provide real-time control systems as grain either enters or leaves the storage silos and are transferred into the feedmill, thereby providing valuable information to assess the total moisture loss from intake through to the mill storage phase.

This will allow the operators to make adjustments based on the real moisture content of the formulated mixture or additional moisture addition, at the mixer or conditioning phase.

Grinding

Losses occur at this process step due to the physical effect of grinding and subsequent moisture loss.

This loss can be greater in 'aquamills' than in commercial feedmills due to the fact in many aquafeed mills there is particularly fine grinding to produce the specific particle size required in fish feeds. Automating the control of the grinders is one method to optimise throughput and reduce energy costs as well as reduce the moisture loss associated with grinding.

Batch control

The weigh scale batching system is often associated with losses due to excessive tolerances and lack of in-flight material control.

Clearly, these losses are significant when you consider micro-scale weighers and the value of the products that are being weighed. Modern appropriately sized, multiple, batch-weigh scales and digital PLC controls should provide accuracies of 0.5 percent or less.

Another fast developing application is using the moisture sensor technology to calculate the water adjustments required at the mixer to offset low dry matter ingredients.

Hand additions and premix additions

The losses that can occur at this stage are significant because of

a) The impact of putting the wrong additive into the wrong feed type or
b) The impact of under or over dosing

The most effective method to reduce the risk of errors is to automate the process using either bar coding or weigh stations or a combination of both. This has the advantage of providing complete traceability which can also limit recall losses if an error does occur.

Mixing

One of the unique features of aquafeed plants is the necessity to mix a large number of liquid products as well as dry ingredients.

It is common for there to be a mixing stage for post ground materials and a further mixer for addition of the finer ground ingredients plus the various liquid products and oils.

Mixing often represents a bottle neck in terms of production, therefore it is important to optimise the scheduling and production planning to ensure optimal throughput.

This can be achieved most effectively through PLC control which can be programmed to control the correct sequence of products to provide constant supply to the pelleting bins.

Extruding, pelleting, conditioning and crumbling

Whether producing shrimp feeds or fish feeds, extruding or conditioning-and-pelleting represent two of the more challenging areas in terms of energy, blockage downtime and reprocessed feeds.

The major limiting factors are manual control and poor steam management.

Automation can reduce the power consumption up to 40 percent as well as improve the productive life of pellet dies and rolls and prevent blockage and cleanout times.

Automation removes the manual variability that leads to sub optimal steam conditioning and power settings resulting in variable pellet quality, which in turn results in higher level of returns from the sieves. This is particularly important when producing crumbs because in some feedmills sieve return levels of 30 percent are not uncommon, which is extremely wasteful as well as resulting in feed being over-processed.

Automation control therefore results in a significantly lower level of returns, reduced down time and efficient feed scheduling

Drying

A feature that distinguishes aquafeed production is the drying process required to achieve the required moisture content to optimise the physical quality of the pellets or crumbles.

This stage of the process however also represents a step that lacks real time control and inevitably leads to over or under drying against target moisture levels.

The new moisture sensor technology referred to earlier offers a unique opportunity to automate the control of the moisture content before discharge from the drier.

The payback from knowing the precise moisture before discharge to the coolers is a significant development for the aquafeed industry and one that can yield a significant return on investment.

Cooling

There are two losses associated with the cooling process.

One is the dust and fines that can be lost from the air ducting due to incorrect set up and fan speeds, and the second is the losses associated with moisture migration.

New technology to reduce moisture loss during the cooling process is now available to the industry – and through Agentis Innovations.

This technology is specifically developed to provide vital information to a PLC in order to perform real-time control of a number of parameters that influence moisture loss.

Similar to the drier stage, the returns in terms of target nutrient content and avoidance of moisture loss yield significant returns.

Sieving

Poor pellet quality leads to increase in fines and dust for rework which incurs losses.

Aquafeed in particular requires various stages of sieving that inevitably lead to more returns. The 'throughs' of the sieves, at all settings, should where-ever possible, be routed back to the pelleting process for immediate re-processing without the need for any intermediate storage or manual handling.

Mills that have particularly long conveyor or elevator handling systems, or fall from the highest point (usually distributor head) also result in more damage to pellets (or segregation of coarse and fine material in mash feeds) and hence dust.

Each time the 'throughs' are recirculated the product is subjected to further heat treatment which will compromise the nutritional quality of the feed, particularly if there is repeat recirculation. This emphasises the importance of optimising pellet quality through the conditioners and pellet and the advantage of automating these process steps.

Packing

Errors arising from placing wrong product in wrong silo or placing product in a silo which is not empty can be avoided by implementing automated route control, fixed silos and high/low level indicators to provide accurate record of how much feed is in each silo.

The other challenge is accurate data about number of bags packed and sent to the warehouse. Weighing systems and bag counting technology can provide the necessary solution so that management are able to log the productivity of each packing line.

Quality control

Knowledge of the moisture content of the feed at packing is essential for physical product reasons, stock loss and shelf life.

Moisture sensors can be installed on the packing line to ensure the optimal moisture content for maximum shelf life leading to reduced product reject and improved consistency of product performance.

Bag loading

This represents a real challenge because the confusion that can occur from having multi-loading belts and different products to load.

The primary concern is inventory control to ensure the correct product type and quantity has been loaded.

Agentis Innovations, for example, has responded to this challenge through the development of their award-winning Q-Plus truck control programme and innovative bag counting technology

Summary

Losses associated with moisture loss, product waste, accuracy of production or time management are costing the aquafeed industry multi million dollars.

Agentis Innovations are actively responding to this challenge by developing technological solutions that directly impact all of these factors and provide valuable real-time stock control, full traceability from supplier to farm and significant return on investment.

Agentis Innovations is a specialist in providing and developing technologies that automate manufacturing processes and integrate data collection for the global agricultural industry which include animal feed, aquafeed, petfood, and premix.

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