



FEED AND BIOFUEL

SHRIMP FEED TECHNOLOGIES

HOW CAN WE HELP FEED YOUR BUSINESS?

ANDRITZ

ENGINEERED SUCCESS

Feeding and fueling the planet

Dedicated to feeding and fueling the planet

ANDRITZ is vital to ensuring a reliable global supply of aqua feed, animal feed, pet food, and biofuel. With full process lines accounting for half the world's production of aqua feed and biomass alone, we continuously support leading producers in achieving the highest levels in safety, quality, and control from feedstock to final product.

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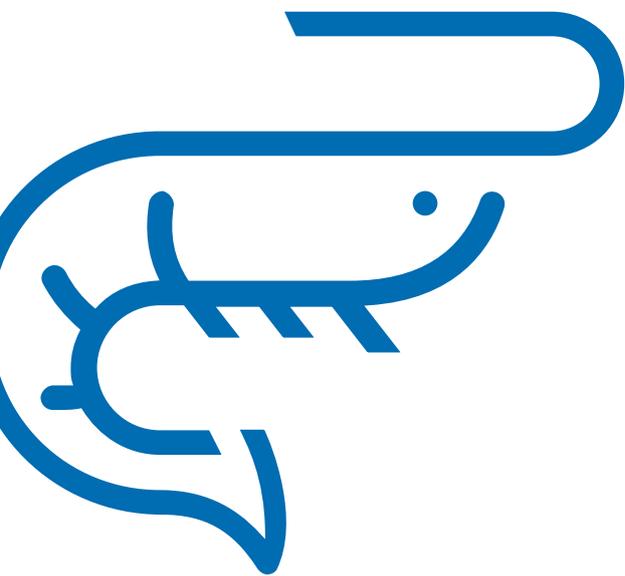
LET'S FEED AND FUEL YOUR BUSINESS

The future of food and energy is full of ambitious ideas such as novel nutrient blends, unique feed properties that boost conversion rates, and high capacity process lines that virtually eliminate waste. To seize upon these opportunities, feed and biofuel producers demand a partner they can trust to deliver the right production capacity with the right service and expertise today – and for decades to come.

As a partner with more than 180 years of industry experience, no one knows more about these opportunities than ANDRITZ. From initial feedstock analysis to grinding, conditioning, and drying. From extrusion and pelleting all the way through to the largest parts and service supply chain on the planet. Together with leading producers in all major markets worldwide, our knowledge, services, and solutions continue to drive the evolution of tomorrow's feed and biofuel production.

Technology for raising the best farmed shrimp

Today's demand for cost-effective yet high quality, high-performance feeds make it clear that producing the best feed requires specialized processing technology. ANDRITZ is one of the world's leading suppliers of technologies, systems, and services relating to advanced industrial equipment for the aqua feed industry.



ADVANCED TECHNOLOGIES

The production of quality shrimp feed depends on factors such as the raw materials and formulation, but superior equipment, designed to produce a pellet has all the right attributes, is truly the key.

ANDRITZ provides aqua feed producers with the technology and services that allows for a competitive advantage.

COMPLETE PLANT SOLUTIONS

ANDRITZ is a leading global supplier of extrusion equipment and systems, with five manufacturing facilities, a global network of sales offices and service centers, and a supplementary worldwide distribution network.

We strive to be your one-stop-shop, whether your needs are for individual process machines, complete processing lines, spare parts or engineering services.

Our dedicated staff of experienced project managers and experts build plants that are easy to operate with short implementation times and proven track record – one that distinguish us from other suppliers and makes us the stand-out partner for the aqua feed processor.

With more than 180 years of feed production experience, ANDRITZ is unique in the ability to manufacture and supply every machine for aqua feed production – from raw material intake to finished feed bulk loading.

PROVIDING CUSTOMIZED SOLUTIONS TO FIT YOUR EXACT NEEDS.

- Process line solutions
- Unit machines
- Technical consultancy
- Engineering services
- Aftermarket service and support

Main machines for shrimp feed processing

Whether it's sink or swim, ANDRITZ extruders will keep your aqua feed production afloat. The Expansion Control and Combi Zone Dryer combine to perfect product density and sinking speed so your aqua feed is always a big splash.

Hammermill



Pellet mill



Optimix



Combi-zone dryer



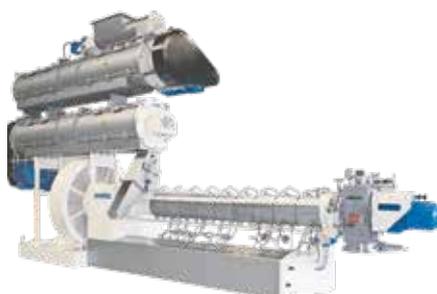
Conditioner



Vacuum coater



Extruder



Shrimp Feed

Producing a sinking pellet that is water stable is the first challenge in shrimp feed production. This is achieved by full gelatinization of the available starch by fine grinding, intense conditioning, processing by pelleting and post conditioning or extrusion.



Access to technology with the flexibility to match the wide variety of nutritional needs and feeding behaviors that occur at different developmental stages is paramount for proper ingestion and growth. Additional factors that dictate how shrimp feed is formed include where the shrimp are being raised. The use of recirculating tanks may require a different product than shrimp produced in outdoor ponds. ANDRITZ has solutions that make it possible to address these and other crucial element in the processing of aqua feed.

Extruded shrimp feed

Extrusion of shrimp feed as an alternative to pelleting enables feed producers to make a more nutritional high value product.

Starch is commonly used as a binder that helps hold pellets together but starch has very little nutritional value for shrimp. Substitution of starch with other protein sources increases the nutritional value of the feed.

Ingredients are ultra-fine grinded using ANDRITZ unique double grinding technique using high-speed MultiMill hammer mills. As a second stage size reduction a pulverizer can be introduced to ensure the demand for ultra-fine particles in the meal. Subsequently a screener recycles oversized particles back into the process line.

All dry ingredients are mixed thoroughly using unique dual rotation batch paddle mixer type OptiMix.

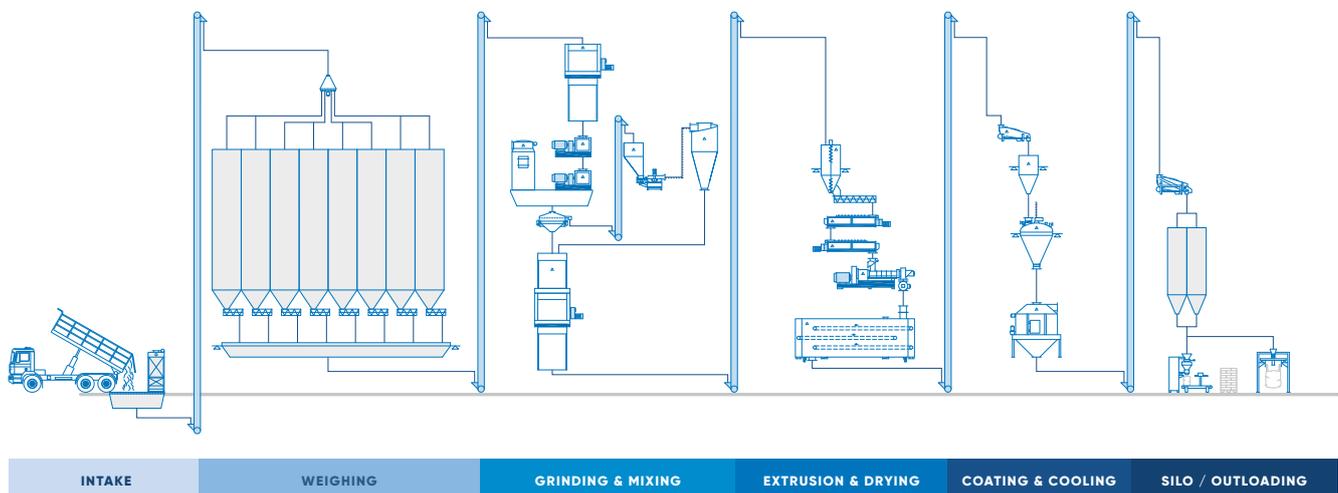
ANDRITZ extrusion technology allows producers to formulate a feed with a reduced starch content – reducing it from the usual 25–35% inclusion to as low as 15–18% ultimately creating improved feed conversion rates and a higher quality end product. The extrusion technology also allows even starter feed to be produced

directly on the extruder without the need for a pellet crumbler, which creates large amounts of scrap or recycle fines.

BENEFITS

- Better energy conversion
- Reduced formulation cost
- Greater variety in raw material choices
- Increased porosity/reduced density
- Increased liquid addition (up to 6 % oil addition in the vacuum coater)
- Pellet sizes ranging from 0.6 mm up to 3 mm
- Longer water stability (6–24 hours) = Less contamination
- Fewer fines

EXTRUDED SHRIMP FEED PROCESSING FLOW



Pelletized Shrimp Feed

For shrimp feed applications ANDRITZ also offers conventional and well-proven pelleting process lines using ring dies and post conditioners

When comparing pelleting and extrusion plants the capital investments are smaller for pelleting mainly due to the more expensive extruder and dryer both in terms of capital investment and operational costs with energy and wear parts.

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Prior to pelleting an intense, high temperature and long conditioning time

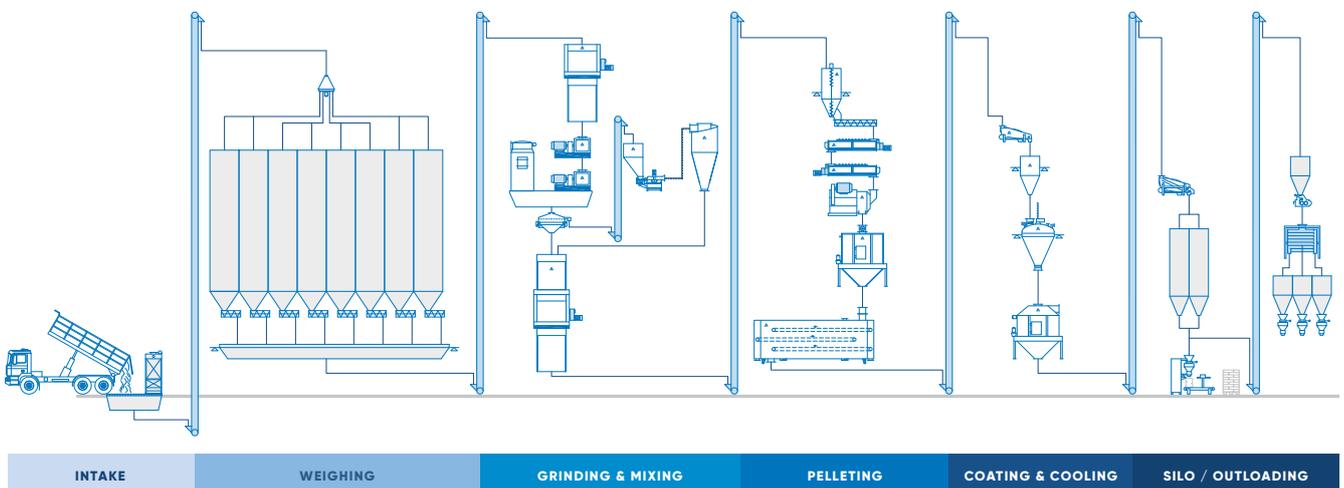
ensures complete adsorption of added liquids and activation of available starch vital for required water stability of finished product.

Dies for shrimp feed applications are carefully selected and this will lead to excellent pellet durability and consequently long and good water stability and full sinkability.

Steam infusion in the post conditioner gives an energy supplement and ensures that the temperature of pellets leaving the pellet mill is maintained for the entire retention time leading to complete starch activation.

A vacuum coater ensures that any necessary oil is deeply integrated into the pellet.

PELLETIZED SHRIMP FEED PROCESSING FLOW



Grinding

Fine grinding is essential to good pellet quality

The correct combination of hammer mill type, screens, hammers, peripheral speed, feeding system, and air flow through the hammer mill ensures the required grinding results and creates optimum conditions for subsequent processes, such as mixing, pelleting, and extrusion. Thus, the grinding process is not merely a question of the hammer mill alone, but also includes everything from feed system to discharge hopper, aspiration filter, and electronic control system.

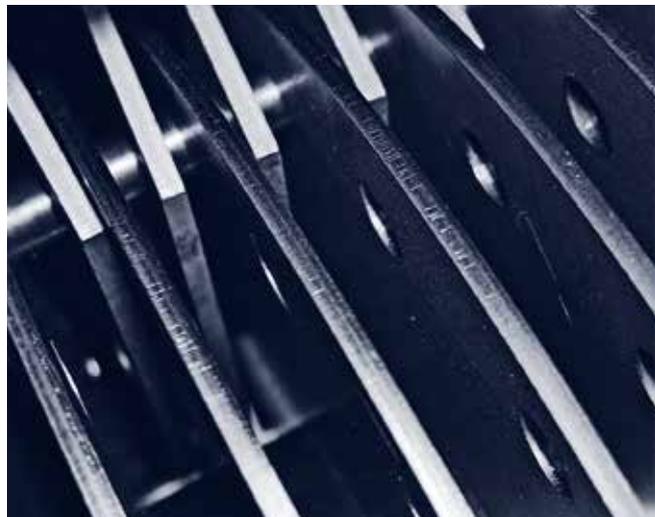
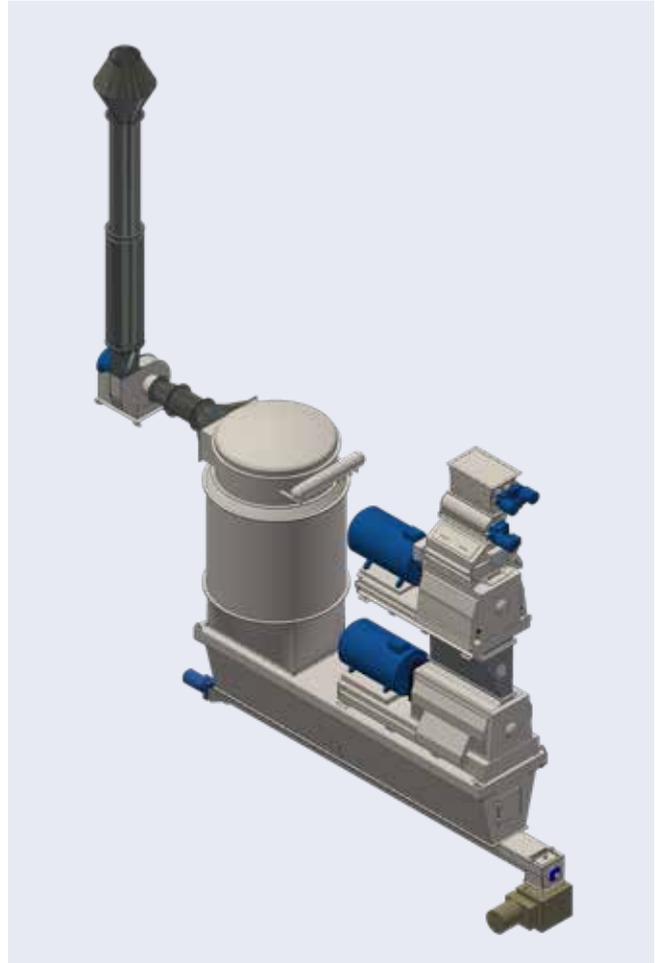
The rotor of the MultiMill series is uniquely designed to allow different hammer-to-screen distance in order to further adjust the particle size distribution.

Multimills are small circle grinders, equipped with two pole motors for high-speed fine and ultra-fine grinding applications such as shrimp and aqua feed. They come in a variety of sizes from 630 mm to 1400 mm long and can be installed in a unique double grinding stack.

FEEDING SYSTEMS

By feeding the material over the full length of the grinding chamber, the particle size can be controlled accurately and the hammers and screens have uniform loading, resulting in longer lifetime of wear parts and higher output per kilowatt.

The feed system, which is available as double screw and separator or as pocket feeder with integrated separator and distribution roll, can be adjusted to suit all raw material types.



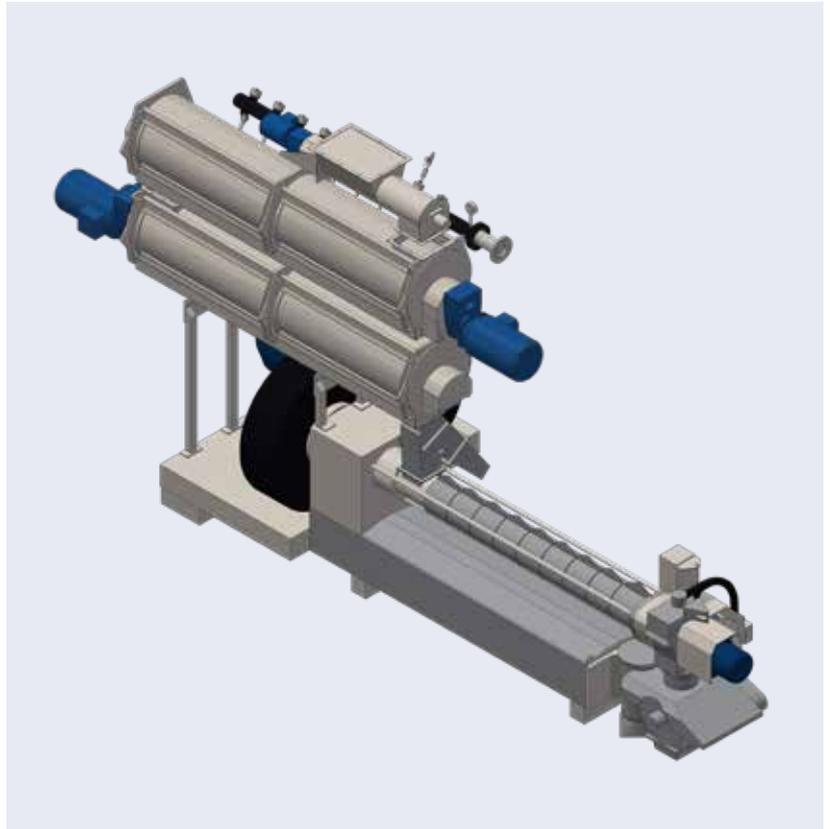
Conditioning

Good pellet quality comes from intense conditioning

The extrusion or pelleting process starts with prime raw materials, precise and accurate dosing, optimum grinding and perfect mixing. However the actual process line always begins with a vital conditioning step where liquids are introduced together with steam which moisturizes and prepares the fine ground meal for further processing in an extrusion or pelleting step.

ANDRITZ offers a wide range of conditioner to suit demands and applications including single shaft and double shaft conditioners. All conditioner setups are built to fit customer expectations in respects to retention time (>120 seconds) and meal temperature to ensure the optimal preparation before entering the extruder.

Andritz offers a hot start conditioner. It works by taking a portion of meal, closing inlet and outlet and steam heating until desired temperature set point has been reached. This ensures that even the first meal leaving the conditioner is properly heated preventing recycling or scrapping saving valuable time and resources.



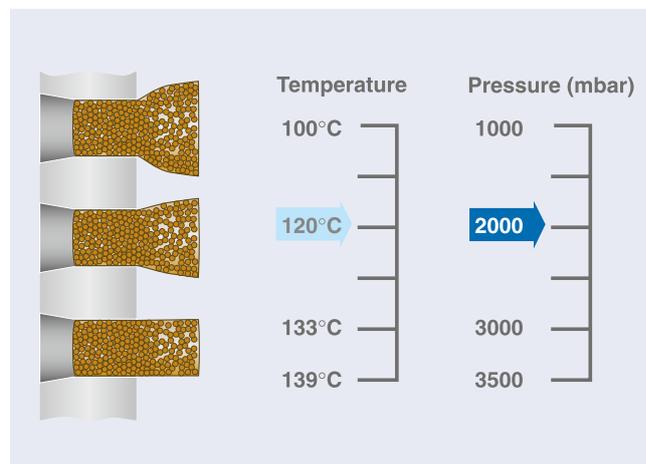
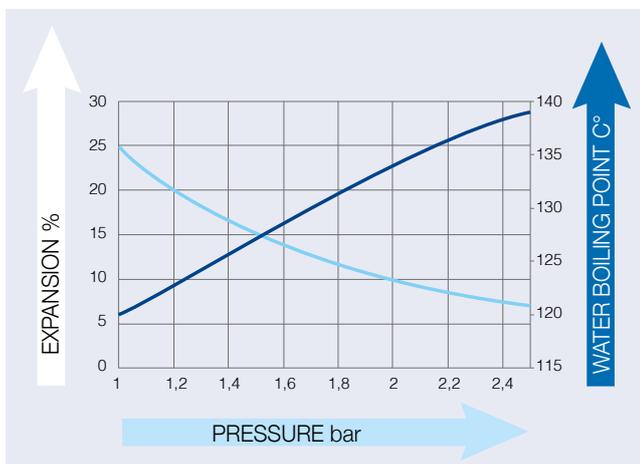
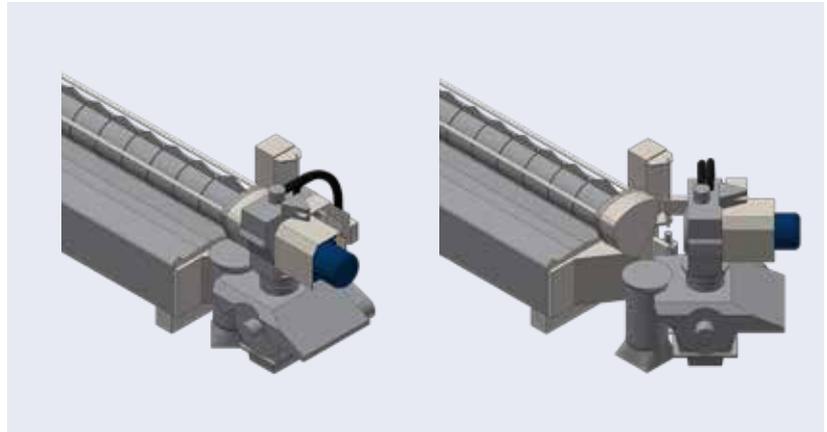
Expansion Control System

An easy way to adjust bulk density

Expansion control system is a unique option to ANDRITZ extruders.

ECS is a unique and patented option for ANDRITZ extruders, which enable precise regulation of the pellet expansion right on the outlet of the die plate. A carefully manufactured rotary valve sits on the outlet of the knife house and enables pressurization of the knife house with up to 3 bar(g).

The positive pressure prevents excessive expansion and problems with pellet sinkability. This feature minimizes the adding water into extruder in order to reduce expansion, which is subsequently very costly to evaporate in the dryer and therefore ensures lower operation cost of the product.



Vacuum Coating

Unique design provides excellent results

The gentle agitation that takes place in the vacuum coating system, prevents damage to shrimp feed pellets.

The feed is gently conveyed into the vacuum coater vertically. The vertical screw disperses the product across the top of the barrel in a thin layer where it is exposed to the addition of liquid ingredients assuring uniform distribution and coating liquids onto the pellets.

BENEFITS OF THE VACUUM COATING SYSTEM

- **High levels of liquid addition**
Up to 35 % of dry matter weight in fish feed
- **Micro ingredients addition**
Enzyme down to 0,01%
- **High spraying efficiency**
Addition of micro liquids
- **Gentle product handling**
No dust created
- **Vacuum pressure**
Suitable for 10 mbar
- **Flexibility**
Large batch size
Prepared for capacity scale-up
- **Two models for wide capacity range**



Horizontal belt dryer

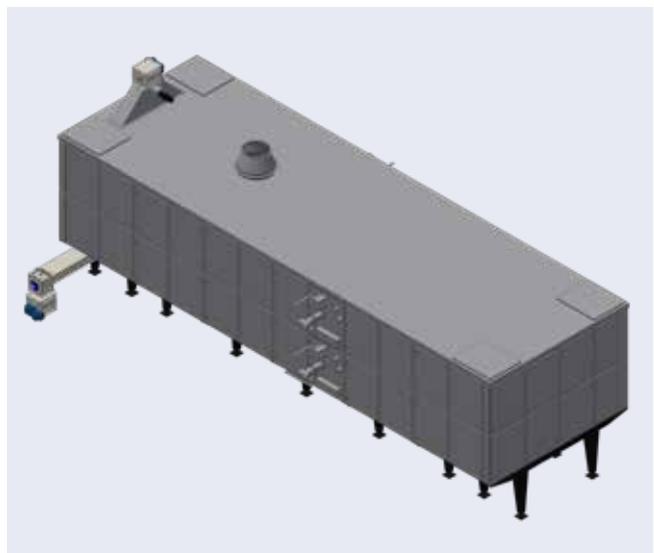
The ANDRITZ Combi Zone Dryer is unique belt dryer with multiple drying and cooling zones providing full control of the drying process. Equipped with a mesh belt it also supports micro-pellets.

ADVANTAGES OF THE COMBI ZONE DRYER

- Gentle handling of products
- High energy efficiency in costs per ton
- Drying process with respect to nutritive value
- Product size range of 0.6-40 mm
- Mesh belt for micro pellets
- Uniform drying of each pellet
- Excellent control at every step of the drying process
- Adjustable retention time
- Servo-driven pellet spreader

FEATURES OF THE COMBI ZONE DRYER

- Gentle and efficient drying
- Individual drying zones
- Temperature control in each zone (50-135° C)
- Control of drying time per deck (15-90 min.)
- Control of air flow direction for each zone
- Hygienic design with automatic cleaning system and removal of fines in each deck (not included in the basic package)
- Integrated drying air system by means of direct gas-fired burners or indirect steam exchanger
- Integrated safety devices
- Easy access to operating systems for maintenance and cleaning
- Modular design for easy installation and upgrading
- Insulated cabinet
- Configuration flexibility – available in two belt widths and with 1-4 decks
- Several accessories and options to match specific requirements
- Standard execution in mild steel and optional in stainless



Solid relationships help one of Ecuador's largest shrimp feed producers reach jumbo proportions

Empagran, the parent company of ABA Balanceados and pioneers in the development of aquaculture diets, is a fully integrated aquaculture company dedicated to the entire shrimp production chain. They manufacture feed for shrimp and tilapia for more than 45 years.

In order to cover the full shrimp production cycles, Empagran bought the feed manufacturing plant ABA Balanceados in 1998, which is located just a few kilometers away from their shrimp pools, the Somar packing plant and their headquarters in Guayaquil. Shortly after the January 1998 purchase, an expansion of the ABA plant was completed, allowing Empagran to produce 6,500Kg bags of feed per month.

At the time of this first expansion, ANDRITZ extruders were chosen for their ability to perfect a dense pellet that will not lose its structure underwater. Production manager, Mauricio Vernaza explains, "Since shrimp are bottom feeders, the pellet must hold together long enough to be discovered by crustaceans roaming the bottoms of the grow-out pond and they must also be dense enough that they do not float. Sinking must occur in just a matter of seconds or shrimp feed quickly becomes bird food."

Equally as important as the "sinkability" of the pellet, is the nutritive quality of shrimp feed. Shrimp feed is complex because it must be nutritionally balanced as well as properly sized for healthy growth at each stage of shrimp development from larvae to adult. "We are continuously improving our nutritional formulas thanks to direct interaction with shrimp and tilapia farms and research groups in the field, with whom we verify the direct results of feed conversion." ANDRITZ extruders



allow ABA to produce the right-sized pellet to match the life cycle and nutritional needs of the shrimp.

"The quality and certifications we have been awarded due to our extensive research and development have led to very high demand for our pelletized and extruded shrimp and fish feed. We sell approximately 85% of the feed we produce to farms throughout Ecuador and many other countries, with the remaining 20% used for the feeding of our own stock."

This growth has prompted the addition of another new plant. The new ABA plant will provide growth areas in the extrusion product line to meet the growing demand for Empagran feed.



Having enjoyed a long and prosperous working relationship of approximately 20 years with ANDRITZ, Empagran will once again install an ANDRITZ extruder.

ANDRITZ was chosen because of their product quality and knowledge and because Empagran's familiarity with their products means less operational training will be needed and implementation will be faster. "However, it is not only because they are a leading brand known for their quality," Vernaza stated unequivocally, "they also have excellent post-sales services. Logistics

are never a problem with ANDRITZ – with other companies, located in other countries, there are language and time challenges that Empagran does not encounter with ANDRITZ because they have representatives and product centers nearby to coordinate and manage projects locally."

"With ANDRITZ I am comfortable knowing there is someone covering my back, someone responsive, who will return my calls to work on challenges when they are presented. But the biggest reason we chose ANDRITZ is that they are a good group of people who are always so easy to work with, and together, we are a team."

The new production line is now in the commission period with the full operational launch planned to occur later this month, April 2018. The new production line will add up to 25,000 tons of feed per year. Currently, ABA is the biggest and most automated plant in Ecuador, and even though it has the capacity to produce any kind of feed, it has specialized in making feed for shrimp its primary focus.



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MAURICIO VERNAZA

Production manager, ABA Balanceado, Ecuador.



GLOBAL SUPPLIER – LOCAL PRESENCE

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How can we help grow your business?

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