



FEED AND BIOFUEL

ADVANCED FEED PRODUCTION TECHNOLOGY

EXTRUDERS

ANDRITZ

ENGINEERED SUCCESS

The advanced single-screw extrusion concept

ANDRITZ extruders provide the latest technology for production of the most demanding extrudates in the aquatic feed and pet food industries.

EXTRUSION FEATURES

- Starch cooking control
- Bulk density control
- Raw material flexibility
- Nutrient advantages
- Optimal product uniformity
- Unique visual appearance

ANDRITZ EXTRUDERS PROVIDE

- Long retention time during conditioning (DUAL Conditioner)
- High-capacity single extruders (EX 0618-0621, EX 1021 and EX1250 series)
- Starch cooking control (Flextex system – patented)
- Density control (ECS system – patented)
- Extrusion Control Management System (ECMS)



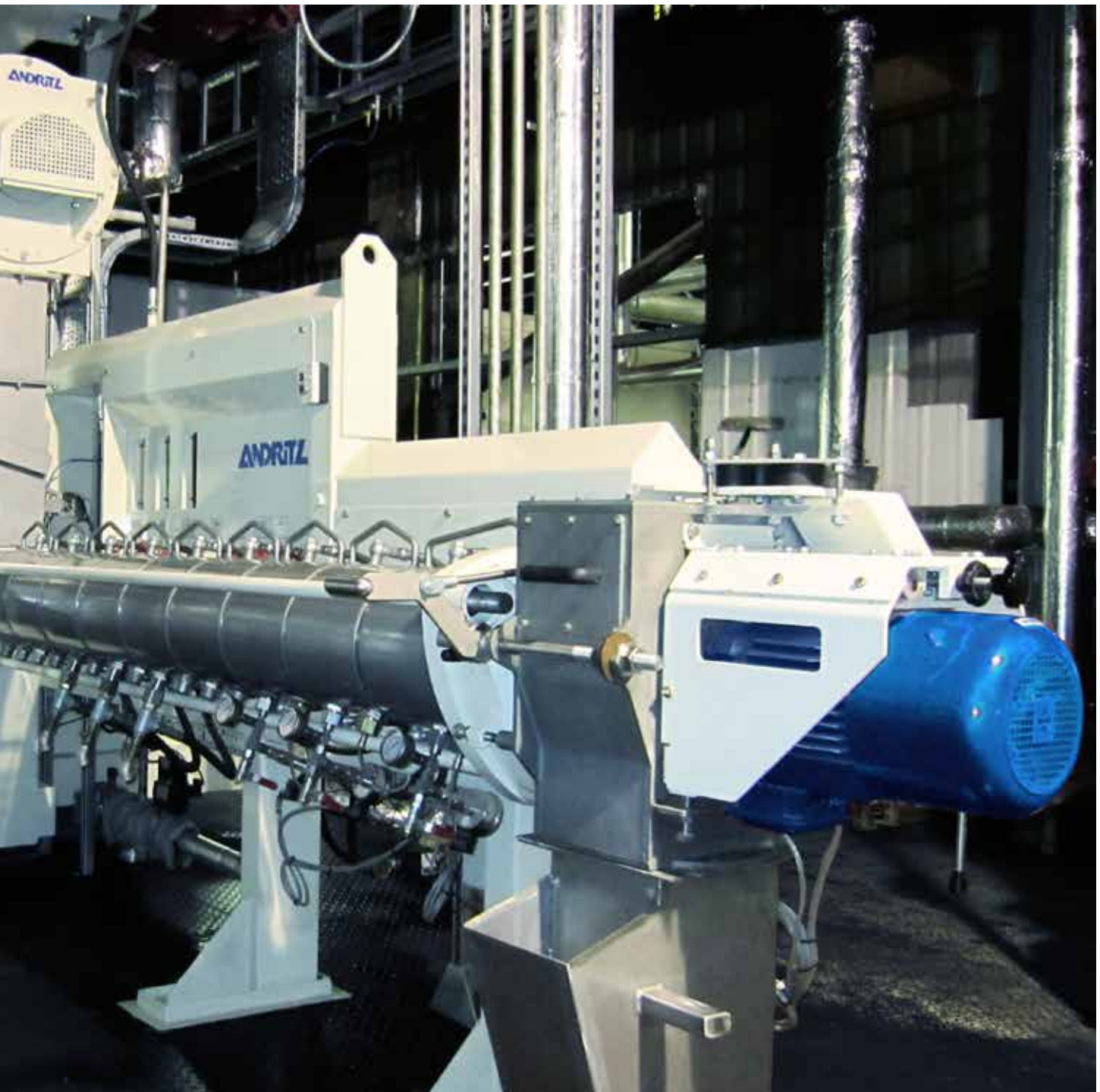
Extruder EX618



Extruder EX0621



Extruder EX1021



EXTRUDER RANGE



Extruder EX1250

Type	0618	0621	1021	1250
Screw diameter mm	177	210	210	250
Length mm	1670	1670	2670	3063
Motor kW	250	315	315	710
Capacity tph	1-4	3-7	4-11	10-20

Options and accessories available to meet specific requirements

1 LOSS IN WEIGHT SYSTEM

- Accurate feeding regardless of changes in raw material density
- Accurate metering of additives

2 PRE-CONDITIONING

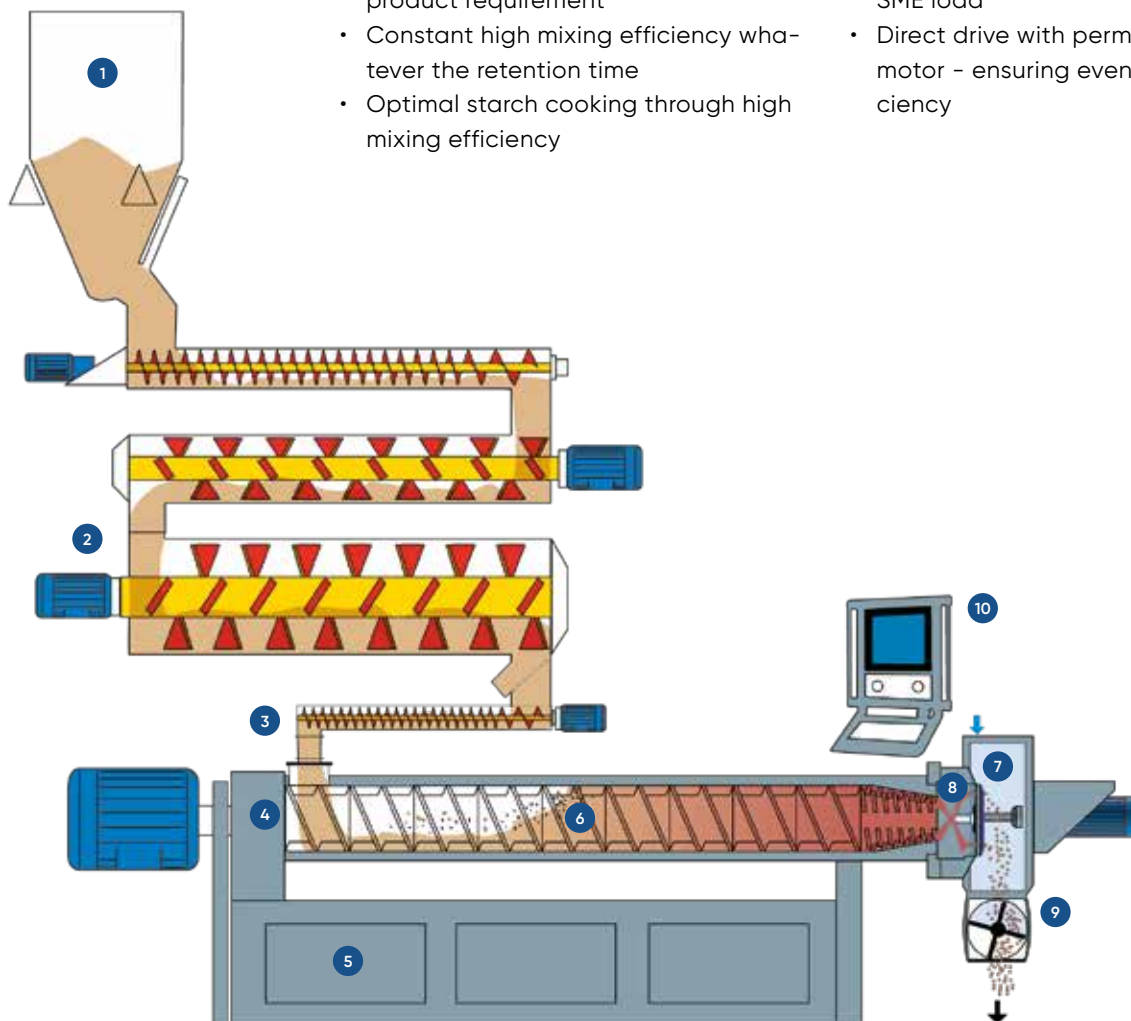
- Single or dual conditioners
- Up to 400 seconds retention time
- Flexible retention time depending on product requirement
- Constant high mixing efficiency whatever the retention time
- Optimal starch cooking through high mixing efficiency

3 FORCED FEEDER

- Avoids blockage in downspout between conditioner and extruder
- Ensures even flow rate through the extruder

4 DRIVE

- Gear or belt drive
- High torque design suitable for high SME load
- Direct drive with permanent magnet motor - ensuring even higher efficiency



EXTRUDED FEED

The demand for high-quality feed, with a pleasing visual appearance as well as the right nutritional benefits, require advanced, multifunctional equipment.

5 EXTRUDER CHASSIS

- Integrated steam and liquid system
- All pipes and valves are located in the extruder cabinet to ensure optimal hygiene

6 SEGMENTED SCREW AND BARREL

- Modular screw and barrel configuration, which can be tailor-made for each application
- The state-of-the-art screw assembly design allows reconfiguration and maintenance with minimum down time
- Tapped screw and barrel design

7 KNIFE HOUSING

- Knives cannot be changed during production. The knives are often changed during recipe change
- Replacing die plates and knives only takes a few minutes
- Standard stanley knife blades are used

8 FLEXTEx SYSTEM FEATURES

- On-line control of starch cooking
- On-line control of product expansion
- Reduced formulation costs, optimum starch cooking

9 ECS FEATURES

- On-line control of product density
- 100% sinking feeds made possible
- Increased extruder output 15 to 50%

10 EXTRUDER CONTROLS

- Full automation
- Traceability
- Product and process repeatability



Advanced extrusion technologies for superior feed characteristics

Back pressure valve (FLEXTEX™) and Expansion Control System (ECS™) combining two unique process technologies for full feed controllability.

SCREW CONFIGURATION FOR OPTIMUM STARCH ACTIVATION

Extruding feed is primarily a matter of cooking the starch. The better the starch is cooked, the better the quality of the feed. However, it is equally important to control the expansion of the feed, thus influencing density which determines both sinking and floating properties.

By controlling the specific mechanical energy (SME) of the screw configuration on the extruder, it is possible to reach optimum gelatinization, thus achieving a product with improved digestibility and increasing growth rate.

On most new extruder designs, screw configuration can be optimized with the SME necessary to match specific product requirements such as those with high fat/oil content, internal oil or similar products with high nutritional value. Screw configuration can be optimized to apply more SME by implementing the following components:

- Screw design and geometry
- Shear locks
- Kneading blocks
- Reverse elements

An optimum screw configuration is not always capable of applying sufficient SME to produce a given product. Often it is also necessary to optimize other parameters that can be used to increase the SME supply in the extruder:

- Screw speed
- Open area of venturi die
- Open area of die plate
- Extruder capacity

THE PHYSICAL QUALITY OF FISH FEED PRODUCTS IS DEFINED BY:

- Density
- Shape and size
- Uniformity
- Durability
- Water stability
- Fast sinking / slow sinking / floating
- Low or high oil content
- Size Ø 0,6 - 40 mm
- High FCR (Feed Conversion Rate)
- Optimal cost efficiency

THE NUTRITIONAL QUALITY OF FISH FEED CAN BE DEFINED AS:

- Recovery of essential amino acids and specific vitamins
- Digestibility

THE PHYSICAL QUALITY OF PET FOOD PRODUCTS IS DEFINED BY:

- Density
- Variety of shapes and sizes
- Optimal crispness and texture
- Even uniformity

THE NUTRITIONAL QUALITY OF PET FOOD CAN BE DEFINED AS:

- Recovery of essential amino acids and specific vitamins
- Unique digestibility and palatability



THE ANDRITZ FLEXTEX SYSTEM REDUCES DOWNTIME AND OPTIMUM PRODUCTION FLEXIBILITY

Changes in screw configuration and other measures that contribute to either higher or lower SME values are all operations that can result in downtime and increased production costs. These changeover procedures can easily take as much as two to five hours to adjust. Therefore, technological advances focusing on both cost savings in the form of reduced downtime as well as optimal flexibility in terms of capacity and quality are in high demand by the feed culture industry.

THE FLEXTEX WORKING PRINCIPLE

The FLEXTEX system is able to continuously control the SME applied in the extruder during operation without changing the extruder configuration or other parameters. By changing only this one parameter, it will have the following advantages in the production of feed:

- The starch cook (up to 100%) is completely controlled during operation
- The bulk density of the product can be reduced by up to 30% and can be controlled with an accuracy of $\pm 5 \text{ g/l}$ (0.3 lbs/ft^3)
- Higher addition of oil and less starch in the formula without significant influence to bulk density and product quality

The FLEXTEX system, located between the screw and the die plate allows the outlet opening to be adjusted from 3000mm to 100 mm² ($4.65 - 0.15 \text{ in}^2$) depending on throughput.

This provides more precise control over the pressure in the kneading zone and the SME applied, cutting down on the amount of energy consumed.

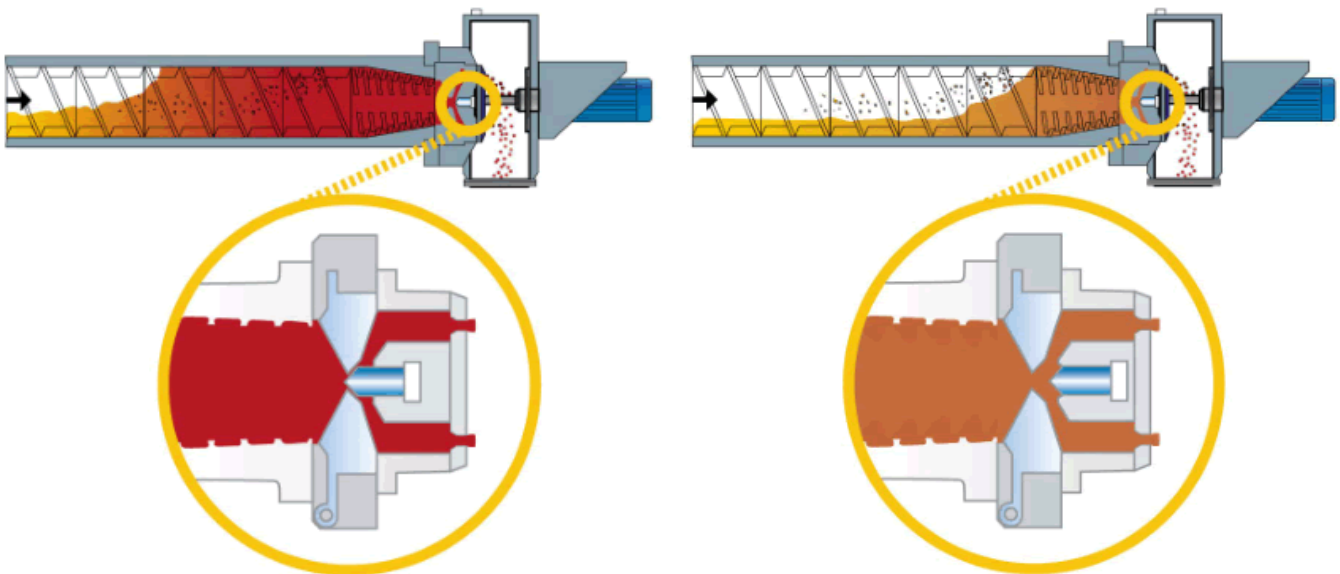
With the FLEXTEX system, the extruder operator can determine exactly how much specific mechanical energy (SME) the product needs. The operator then determines the set-point from the control system, either from a separate control or an integrated control; for example, kW/ton (HP/ton) dry matter. The FLEXTEX system automatically adjusts using a hydraulically controlled piston to increase or decrease flow through the outlet.

THE MECHANICAL DESIGN

The FLEXTEX system consists of 3 parts:

1. The PLC control system
2. The venturi die and the piston system
3. The hydraulic station

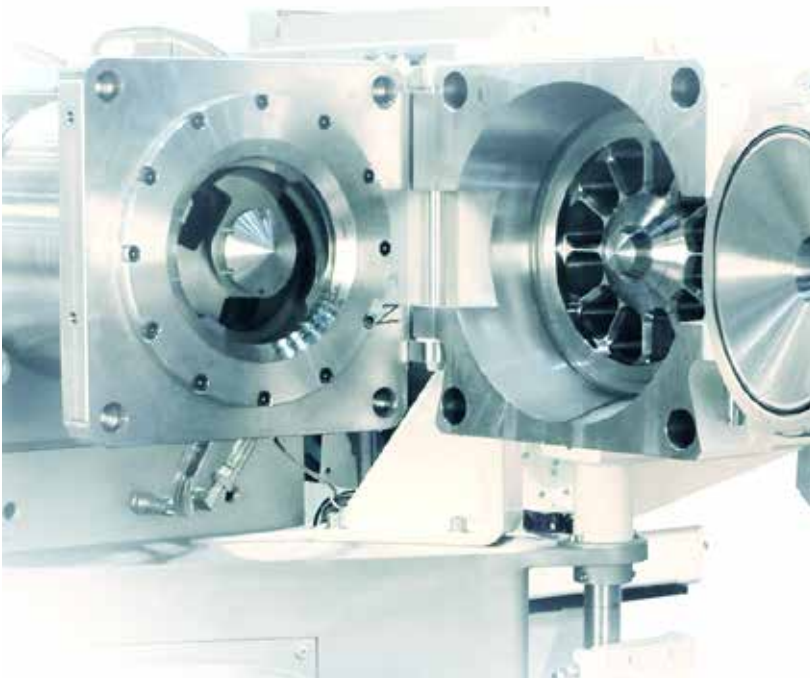
ANDRITZ designed the FLEXTEX system with a focus on simplicity. Fewer parts mean less upkeep and thereby reduces your cost to maintain. The primary component of the FLEXTEX system is the piston, which is used to restrict the meal flow as well as distribute meal to the die plate. It is essential that these actions take place synchronically so that movement is unhindered. Changes in the meal flow due to uneven pressure at the die plate can ultimately influence the visual quality of the product. The FLEXTEX system solves any possible inconsistencies by moving axially and, at the same time, conical so that the meal flow remains even.



FLEXTEX in neutral position – no additional SME applied

FLEXTEX in closed position – additional SME applied

A



A Extruder with FLEXTEx installed

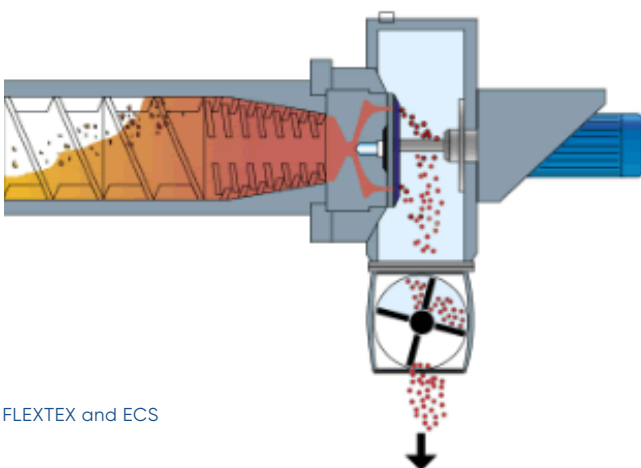
B Extruder with ECS installed



THE ANDRITZ EXPANSION CONTROL SYSTEM (ECS) – FOR INCREASED BULK DENSITY

The Andritz Expansion Control System (ECS) is unique in its ability to control the bulk density of a wide range of products while also optimizing product quality. The ECS concept is based on controlling the expansion in the extruder knife house without influencing the product quality. Thus all desirable parameters can be used in the extruder without regard to expansion. The main focus here is product quality.

By adding compressed air in the knife house, it is possible to control and adjust the pressure. This is made possible by mounting an airlock under the knife house (see figure below). Increased pressure in the knife house results in a reduction of flash-off and thus, increases the bulk density.



FLEXTEx and ECS

DOCUMENTED RESULTS FROM THE FLEXTEx AND ECS SYSTEMS

The FLEXTEx and the ECS systems can be installed individually or as a combined concept. This is simply a question of each producer's requirements. The results of documented tests from full scale operations demonstrate significant advantages when using the Extruder with ECS installed FLEXTEx and ECS ANDRITZ FLEXTEx and ECS system. The figure below shows the results of tests that were conducted on a shrimp feed formula containing 70% protein.

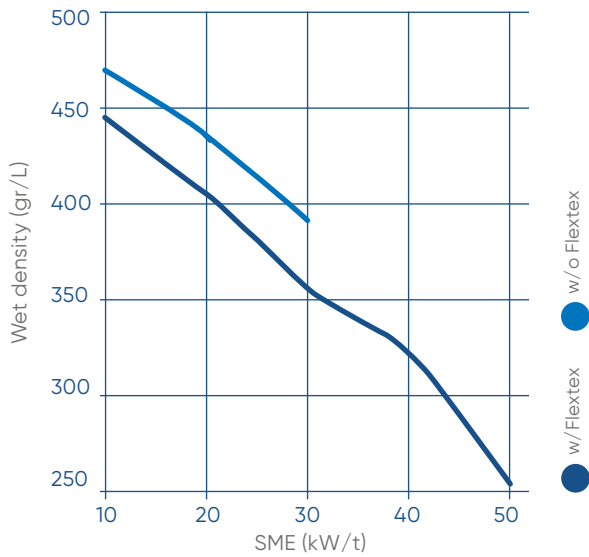
SUMMARY

The FLEXTEx and ECS systems provide significant flexibility in the production of feed for all fish species. By continuously controlling the SME and the ECS during operation, it is possible to control both the physical quality and the product density. Two unique tools for controlling finish product characteristics are present. The advantages of the systems can be summarized into:

- Increase starch cook by 10-15%
- Decrease bulk density by 20-30%
- Increase bulk density by 0-5%
- No change of screw configuration which means reduced down time
- Only two parameters needed for controlling starch cook, reduced and increased bulk density.



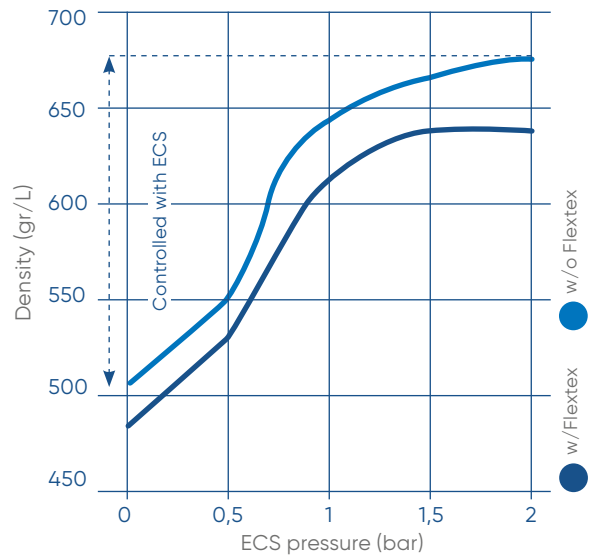
SME FLEXIBILITY



TEST A: FLEXTEx EFFECT ON STARCH COOK

By increasing the SME in the extrusion process by approximately 12%, the cook rate was increased by 11.8%.

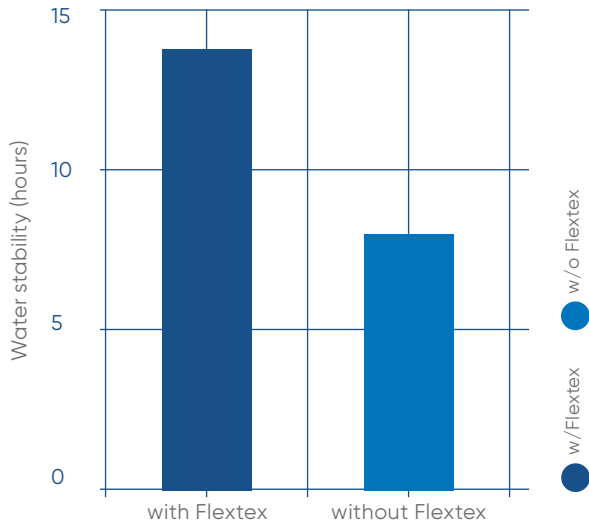
EFFECT OF ECS ON BULK DENSITY



TEST B: ECS EFFECT ON BULK DENSITY

The ECS can increase the bulk density by 25% by adjusting the pressure in the knife house only.

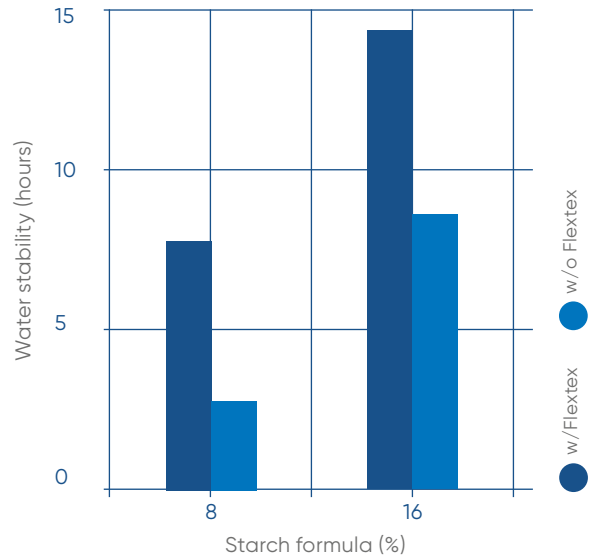
FLEXTEx EFFECT ON WATER STABILITY



TEST C: FLEXTEx EFFECT ON WATER STABILITY

By increasing the SME it was possible to increase the water stability by an additional 6 hours.

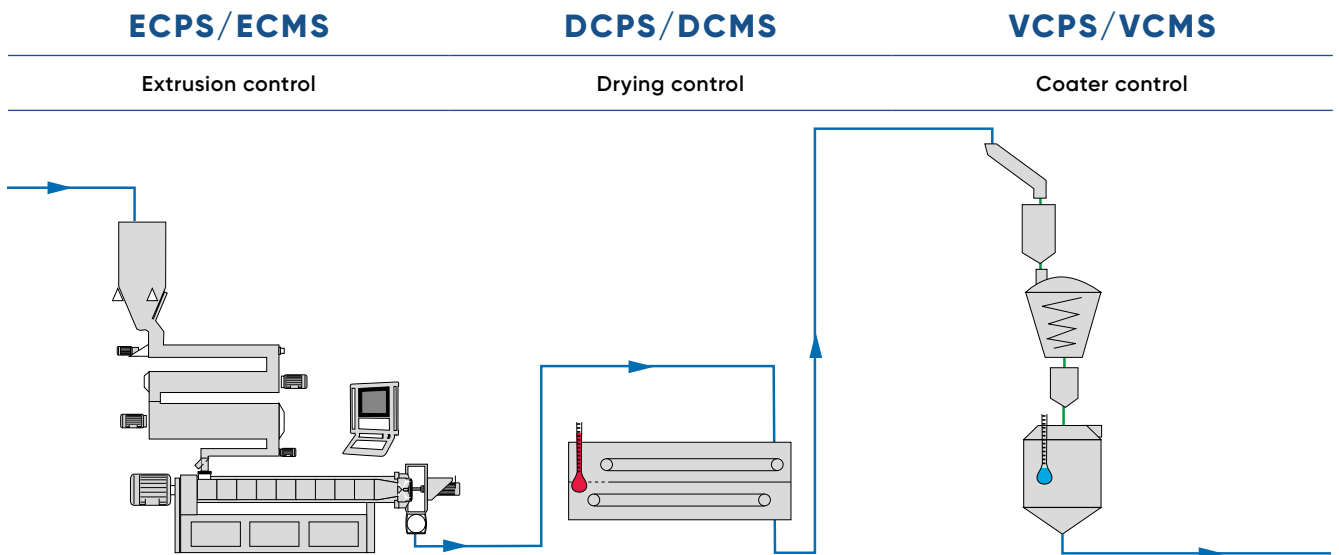
STARCH CONTENT VS. WATER STABILITY



TEST D: REDUCED STARCH CONTENTS IN FORMULA BY MEANS OF FLEXTEx

By reducing the starch contents by approximately 50%, equal water stability (8 hours) could be obtained as with the original high starch formula, but without FLEXTEx (8 hours).

Control systems for each stage of the processing line



PROCESS CONTROL SYSTEMS

Type	Extruder	Dryer	Coater	Touch control panel system	PC remote management system
Basic	ECPS	DCPS	VCPS	x	
Extended	ECMS	DCMS	VCMS	x	x

BASIC FUNCTION CONTROL

Stand-alone control system

- Extruder – ECPS;
Extruder control panel system
- Dryer – DCPS;
Dryer control panel system
- Coater – VCPS;
Coater control panel system

FUNCTIONS

- Basic functions
- Basic operation of equipment
- Manual settings/readings

EXTENDED FUNCTION CONTROL

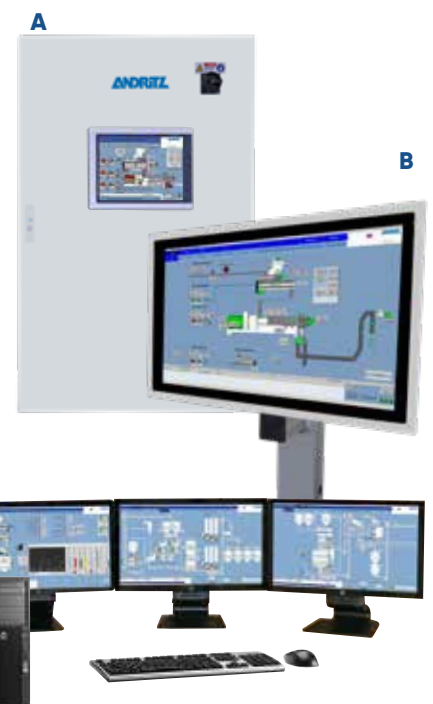
Client server-based control system

- Extruder – ECMS;
Extruder control management system
- Dryer – DCMS;
Dryer control management system
- Coater – VCMS;

Coater control management system

FUNCTIONS

- Extended remote control
- Fully automatic control
- Total traceability
- Auto start/stop feature
- Production management
- Database
- Recipe logging
- Remote online support



- A** Touch control panel system
- B** Server installation for control room
- C** Touch client for field installation

Keep your business growing with our global service network

Our excellent aftermarket service and support is what sets us apart from our competitors. Our cooperation with our customers does not end with the sale – or the machine installation. The good customer relationship is extended through important after-sales service and support.

OUR SERVICES

Our highly skilled and motivated employees stand ready to help you with:

- After-sales services, support, and follow-ups
- Spare and wear parts, maintenance, and repairs
- Process optimization
- Training of plant operators

FIELD SERVICES

We offer our customers excellent field services, where our service technicians come to you and your plant for assistance. The depth and experience of our field service specialists is unmatched – backed by the full knowledge and technical support that only the equipment manufacturer can provide.

BENEFITS

There are several benefits to be gained from continuous upgrades, optimizations, and services on your equipment:

- Maximum production
- Process knowledge and experience
- Reliability and cost efficiency
- Reduced life cycle costs
- Short and effective shutdowns
- Improved energy efficiency



SPARE AND WEAR PARTS

ANDRITZ spare and wear parts warehouses are located at strategic locations worldwide.



GLOBAL SUPPLIER – LOCAL PRESENCE

With sales, service, engineering, manufacturing and production sites located all around the world, ANDRITZ Feed and Biofuel is truly a global organization with a local presence. 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.

How can we help grow your business?

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