



TOVALIA
OUTILS DE MESURE EN AGROALIMENTAIRE

PROCESS CONTROL IN AQUAFEED PRODUCTION

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Tovalia Intelscan sarl



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Founded in year 2000, at the Icelandic Technical Research Center in Reykjavik as Intelscan.

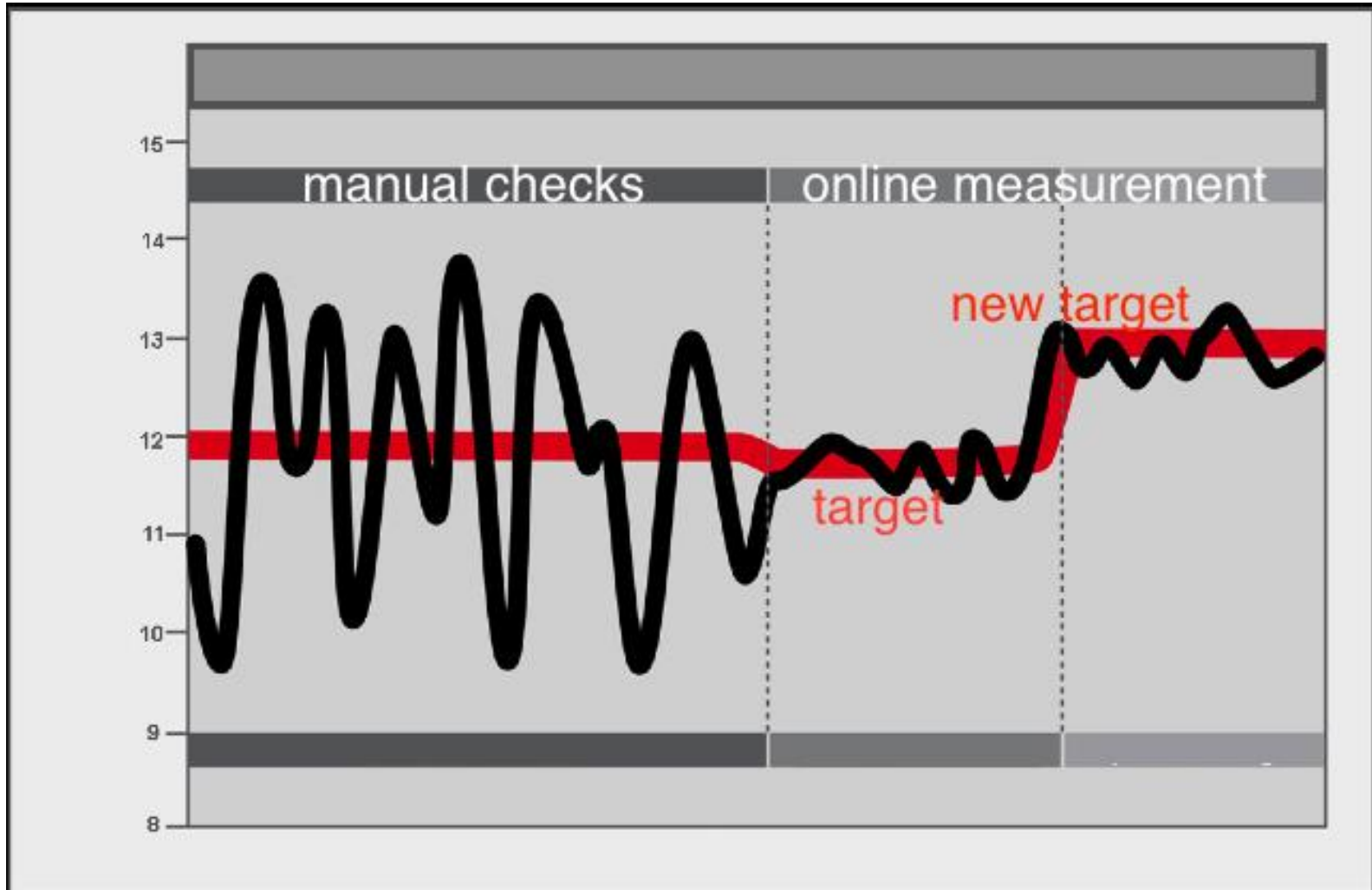
Moved to France in 2013 as Tovalia Intelscan sarl.

Winner of Aquafeed Innovation award at Victam Europe in 2015.

analysis tools for process optimisation and quality control



Importance of online monitoring





Control Parameters

Control of the production process is crucial → *correct product quality*

During the production process the raw material is treated in various equipment. Important to finetune

- *Temperature*
- *Steam*
- *Oil addition*
- *Moisture*
- *Physical reaction*
- *Chemical reaction*



The Result

Control of the process improves the quality of the fish feed:

- *Maintain nutritional value of the raw material through the production process*
- *Feed able to withstand transport, storage and automatic feeding systems - **DURABILITY***
- *Feed with the desired sinking ability - **BUOYANCY***
- *Good water stability with no leakage of nutrients*



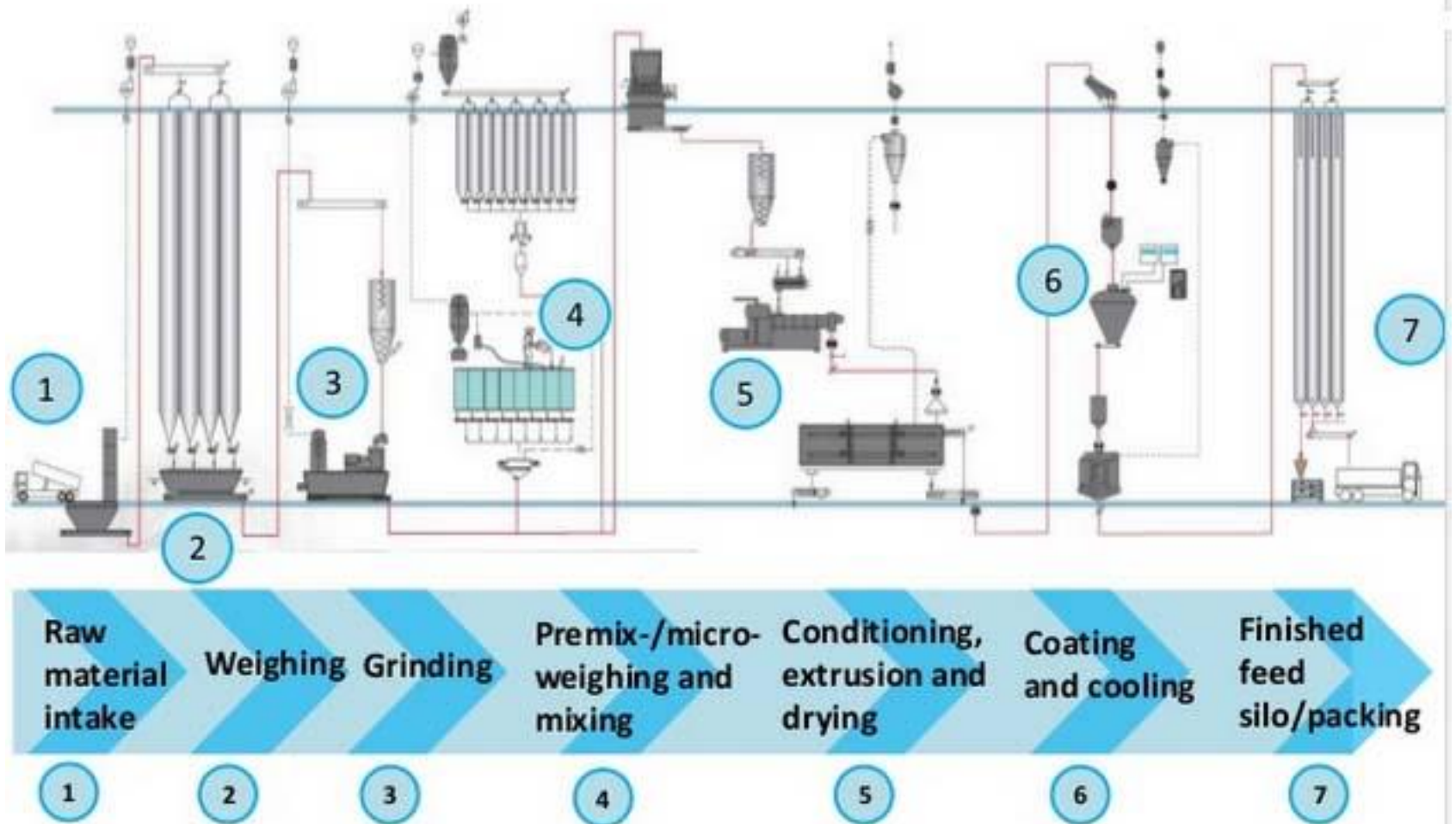
Production Process

The production process is generally in ten steps:

1. *Raw material intake*
2. *Weighing / Batching*
3. *Grinding*
4. *Mixing*
5. *Conditioning*
6. *Extrusion (for floating, slow sinking and sinking feed pellets)*
7. *Drying*
8. *Coating*
9. *Cooling*
10. *Packing*



AQUA FEEDS: PRODUCTION FLOW





Parameters measured

Following 5 parameters are the main variables that can be measured to better control the production process:

- Moisture content of raw material and pellets
- Density of pellets
- Pellet size
- Oil coating of pellets
- Temperature



Moisture Content

Correct moisture level is very important financially, nutritionally and in terms of quality

Moisture can be added in batch mixer, conditioner and extruder

Moisture can be removed in the dryer and in the cooler

Important to measure the results when adjusting the moisture level.

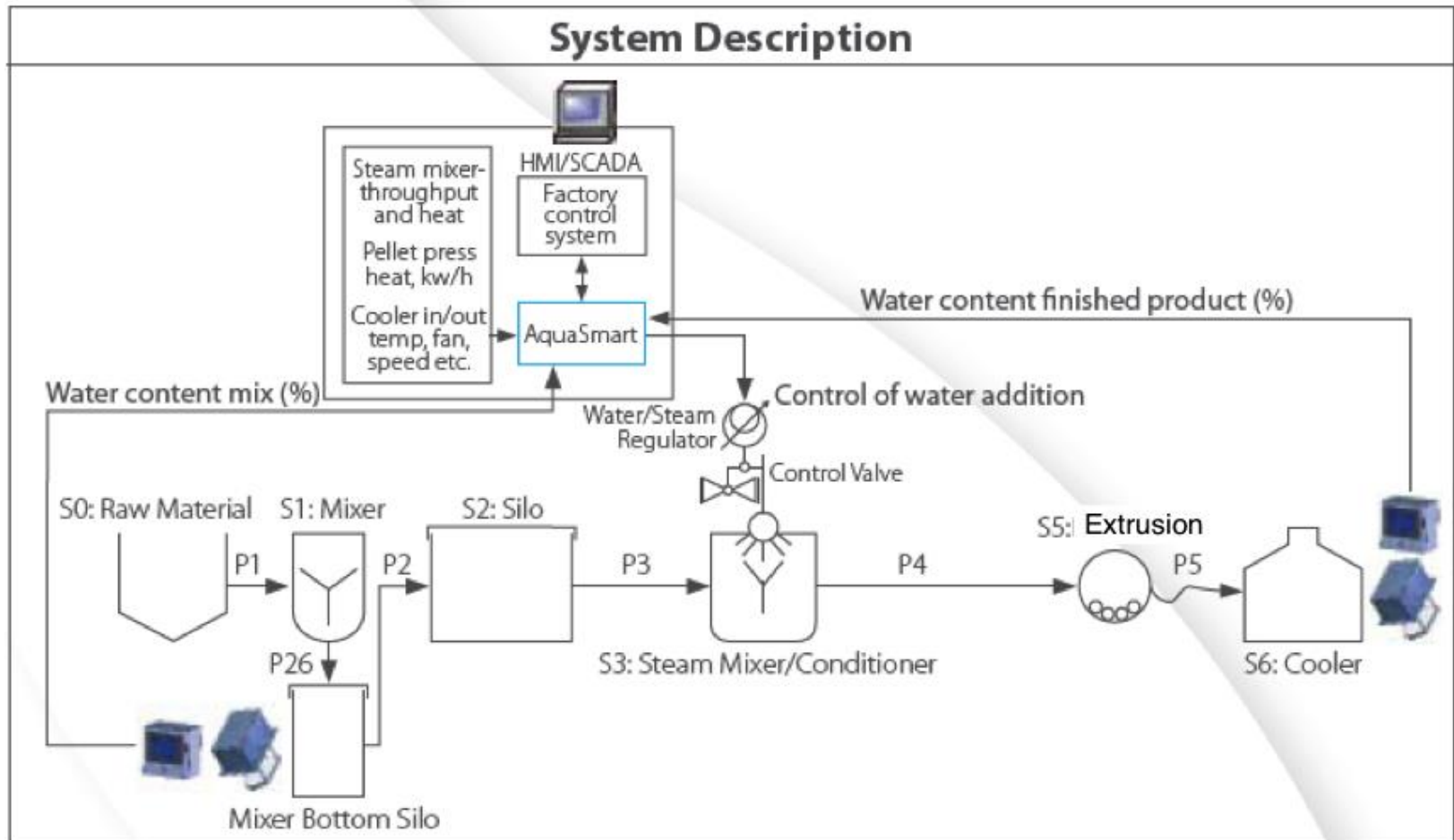
online moisture sensors for

- ***batch mixer***
- ***after extruder***
- ***after dryer***
- ***after cooler***



Moisture Addition

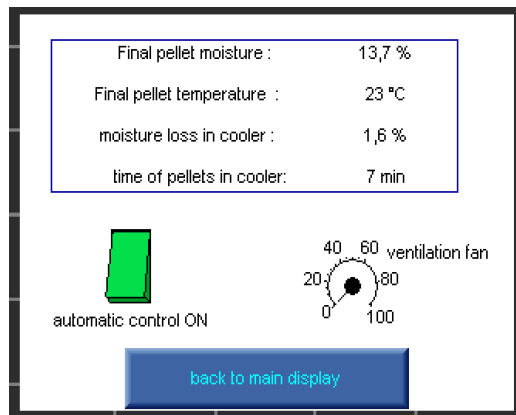
Moisture content can be controlled by water addition in batch mixer or in conditioner





Moisture Removal in Cooler/Dryer

Usually the cooler takes in ambient air to cool down the pellets



Parameters measured

- Ambient temperature
- Temperature of air exiting the cooler
- Humidity of air entering the cooler
- Speed of air exiting the cooler
- Temperature of pellets exiting cooler
- Moisture content of pellets exiting cooler

Gives information to control the final moisture content by regulating the air flow and the retention time of pellets inside the cooler

Financial Benefits of correct moisture level



- case study



During a 10 day production period, the average level of moisture was 13.7%

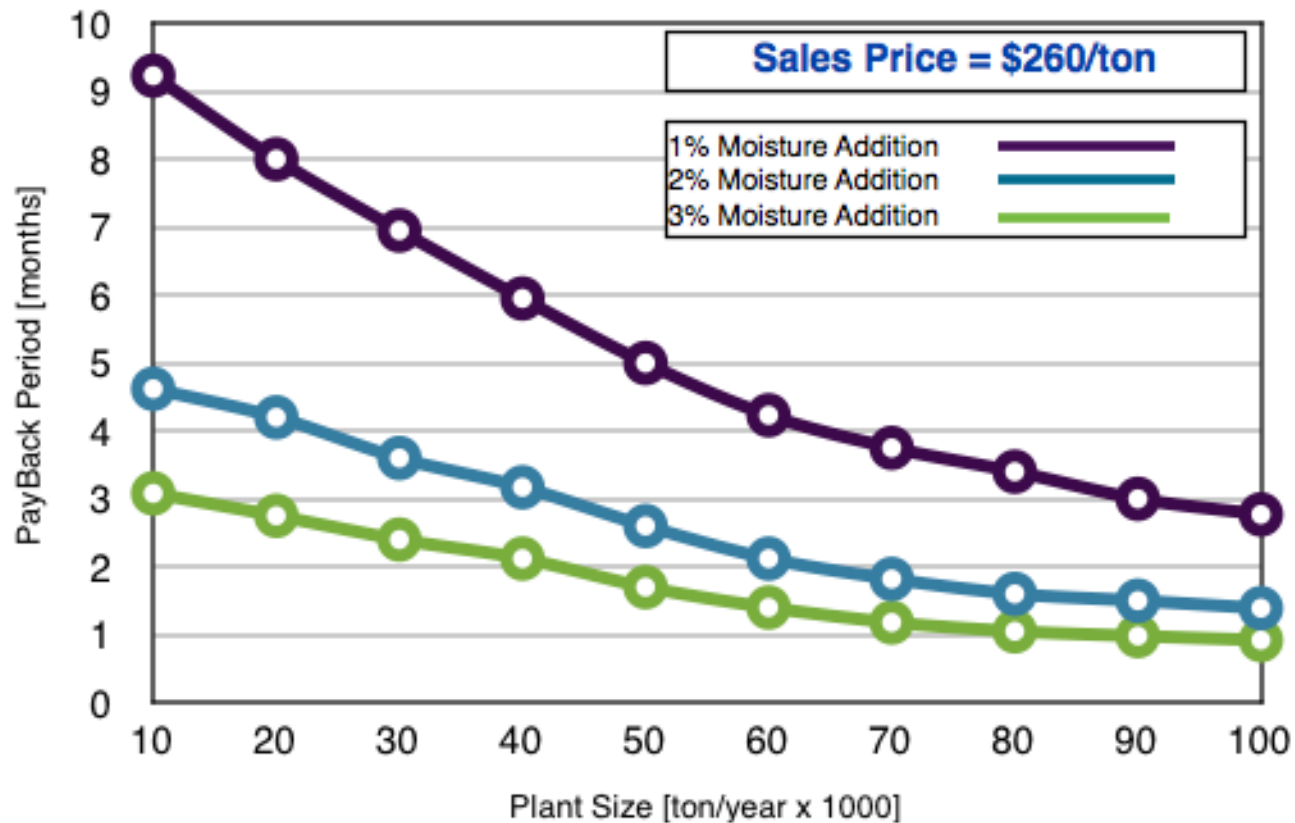
Additional 0.4% moisture was required to achieve the formulated level for the finished product.

During the 10 day production period, 2,524 tones of feed was produced, out of which an **extra 9.56 tones** of liquid was included to achieve the required level.

Almost 1 ton added product each day.



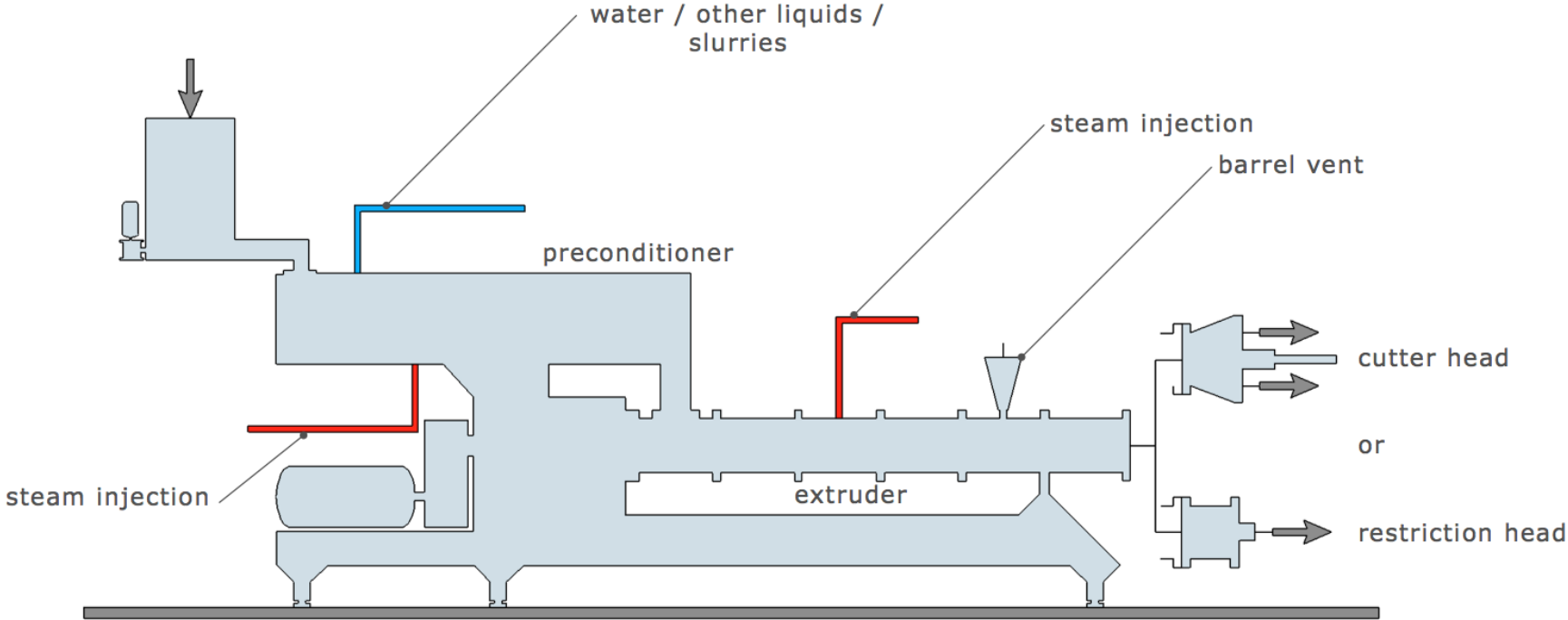
Financial benefits continued





Density of pellets (weight per volume)

Density of pellets can be controlled in the extruder.
By adjusting the steam, pressure and water content in the extruder it is possible to get the correct density.





Density of pellets

Special equipment can measure the size and weight of individual pellets, therefore obtaining the true pellet density – not bulk density of a fixed volume.

Done by combination of digital image processing and load cells.



Very important to control the sinking properties of the fish feed pellets (buoyancy).



Pellet Size

Using digital image processing, it is possible to monitor the size of pellets.

Change in size may indicate that the die of the extruder needs to be cleaned, or the amount of steam adjusted.





Oil Level

Oil is added to the pellets in the coater, after the dryer. A shininess sensor can be used to measure the absorption of oil into the pellets. It is not desirable to have the oil on the outside of the pellets. The oil is then likely to leak off. Oil on the outside of pellets is detected by a light reflection sensor.

Online shininess factor is used to control the oil dosing. A shiny pellet will indicate to the operator that oil is not being absorbed into the pellet.





Temperature

Temperature is normally measured with a contact probe (PT100) or infrared sensor.

Temperature should be monitored at various stages to ensure that the processing equipment is working properly and not damaging the raw material.

Temperature monitoring of pellets in the cooler is also very important to ensure that the pellets have reached ambient temperature when they leave the cooler.



Conclusions

Process stage	Parameter	Action
Batch mixer	Moisture	Add moisture according to formulation and processing requirements
Conditioner	Moisture	Add moisture to meet processing requirements
Extruder	Density Pellet size	Change extrusion parameters to get correct density Monitor the die wear and tear
Dryer	Moisture	Control temperature and retention time in dryer
Coater	Shininess	Adjust the oil dosing rate
Cooler	Moisture Temperature	Control the air flow and retention time in cooler



Thank you!