PET FOOD INDUSTRY

FROM PREMIUMIZATION TO TWIN SCREW EXTRUSION

SUMMARY

INTRODUCTION

How the relationship between pets and their owners impacts pet food markets?

The relationship between pet owners and their pets is becoming more and more fusional and can be compared to a parent-child relationship.

In fact according to recent surveys, 9 out of 10 pet owners consider their pet a member of the family and over 50% of them give pets presents at Christmas.

It is reported that there are approximately 600 million dogs and cats in the world (2016) representing a global pet food sales level of 70 to 80 billion USD. *(= Pet products such as Cat litter, Pet healthcare, toys...are not included here)*

Pet food production represents 28 million tons of prepared food/year; large variations are noted depending on world regions.

The continuous overall Growth Rate (GR) is estimated between 3% and 4% worldwide, according to market studies.

Pet Care segmentation

PET FOOD

- Dog Food: dry, wet, treats (Over 70% in sales)
- Cat Food: dry, wet, treats (Over 70% in sales)
- Bird Food
- Ornamental Fish Food
- Small Mammal and Reptile Food

PET PRODUCTS

- Cat Litter
- Pet Dietary supplements
- Pet Healthcare
- Other Pet products

PET FOOD MANUFACTURING
A Constantly Growing Market

Focus on dog and cat food

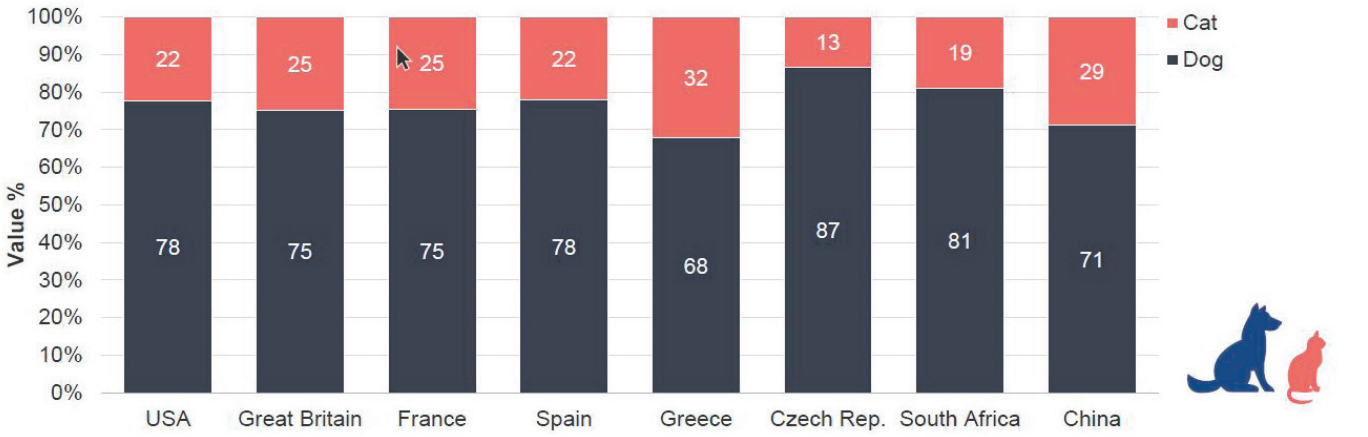
As we can see on the chart «Species by Country» in the represented countries the sale of dog foods is much higher than the sale of cat foods. Example: + 21% GR for dogs and + 14% for cats in Central Europe.

The second chart «Food Type by Country» shows that dry foods are the most sold food type worldwide.

THE SHARE OF PREPARED FOOD FOR DOGS AND CATS IS INCREASING WORLDWIDE

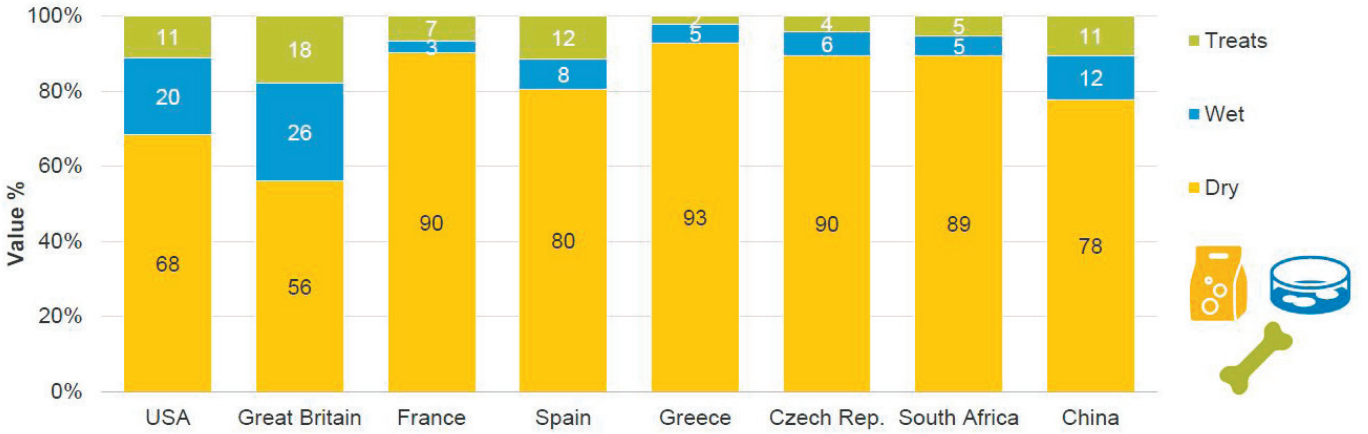
Species by Country

2015 Dollar Share of Sales



Food Type by Country

2015 Dollar Share of Sales



Trends In Pet Food Innovation Are Growth Drivers

Pet owners are pushing the industry to offer better products for the animals consuming the food.

Pet food follows broader human food trends because it must appeal to pet owners who buy it, and these consumers are now expecting the same high standards for their pet's food as their own: convenience, quality, authenticity, and transparency. In addition, trust, value and ethics affect their decisions, depending on each buyer's personal beliefs.

Every player involved in the pet food industry is concerned with safety, quality of ingredients, limiting additives and preservatives (no artificial colors, flavors or preservatives, grain-free food, fresh meat, fortified with DHA, vitamins, prebiotics, reduced fat content...), sustainable manufacturing processes and distribution of the finished products that will keep pets healthy and happy.

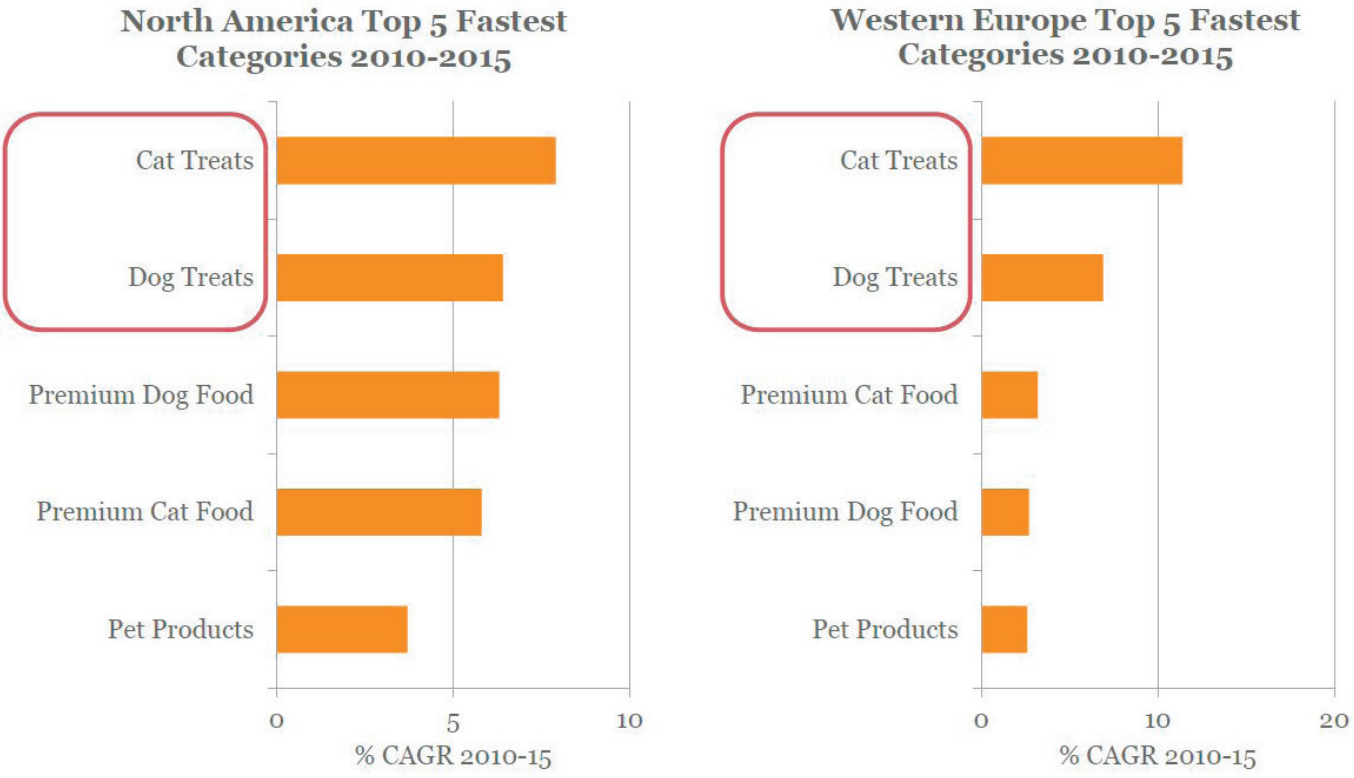
HUMANIZATION of pets has expanded into the humanization of their food. Processors are making pet foods that resemble human food, influenced by "free-from" claims, with clean labels, and homemade appearance. Even product names are evolving. You can now buy muffins, crisps, popcorn, beer and wine for your dog and cat!

The expansive flavor and texture varieties of single–serve wet cat food also reflect the trends of humanization and premiumization.

Treats reflect this trend. They are recognized as pet food, not intended to be a source of complete and balanced nutrition; but used as an occasional reward or indulgence for pets.

TREATS ARE USED AS AN OCCASIONAL REWARD OR INDULGENCE FOR PETS.

However to satisfy pet parents, brands are developing beneficial treats that allow pets to indulge while keeping within the guidelines of their veterinary-recommended diets. *See «Top 5 pet food categories» chart»*



Top 5 Pet Food Categories in North America and Western Europe

EUROMONITOR INTERNATIONAL

PREMIUMIZATION

The claims for premium foods have increased for human food as well as for pet food including reliable origins, quality, and even sustainability of ingredients.

Pet food recipes have to be simple and natural, with high animal protein and/or vegetable protein content.

Manufacturers are working to increase the quantity and the quality of the proteins in their recipes.

Fibrated vegetable protein, exotic animal proteins and insects are considered today as valuable alternative sources. These options are meeting the growing demand for products with lower environmental impact, higher sustainability and reduced costs in the diet of the entire family-including the pet members.

Between 2011 and 2016, the growth rate for premium pet food has been calculated at between 2% and 14% depending on regions worldwide.

This represents a GR of + 7, 5 % on average!

DRY PETFOODS AND TREATS

As seen in the «Pet Food Segmentation» (page 1), there are many types of petfoods. In this study we will focus on dry pet food and treat categories.

Kibbles

Kibbles can be of very varied shapes and appearance: bones, stars, triangles, hearts, bicolored... The recipes are also diversified and include ingredients adapted to each pet species, breed, age, size, health needs...

Pellets

Bones

Stars

Triangles

Hearts

Ribs

Crosses

Fishes

Filled Kibbles

Filled Kibbles such as pillows are stuffed with a soft tasty filling and are particularly appreciated by cats for their bi-texture.

Treats

Treats are one of the strong growth-drivers in pet food.
These extruded products are generally not expanded and typically require a degassing unit or density control to maintain a low temperature at the exit of the die.

A dryer is not mandatory but the moisture content and temperature must be adjusted, for example, by means of a cooler.

The texture may be soft and/or chewy, depending on the quality request.

HOW IS PET FOOD MANUFACTURED ?

Utilizing extrusion technology and particularly when using twin-screw extruders, it is possible to consistently produce high quality premium dog and cat food as well as treat products using sophisticated recipes (high protein, low carb, grain-free, fresh meat, etc...).

Extrusion Technology

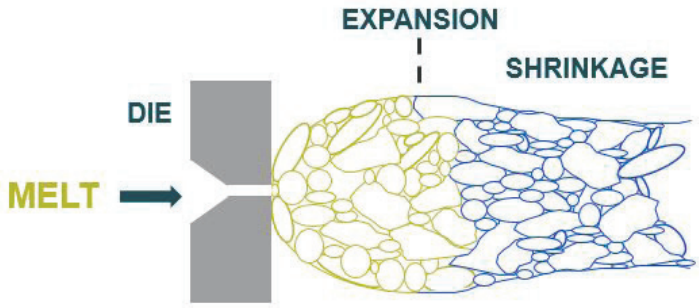
Extrusion has long been utilized in pet food production, and today it is a relevant technology to help pet food producers to bring to market kibbles and treats that are answers for new trends including health, nutrition, transparency, convenience and snacking.

Advances in extrusion technology and process expertise have opened the door to the next generation of innovative pet foods and treats.

Direct Expanded Pet Food

Extrusion is a thermomechanical process consisting of mixing and cooking ingredients with regulated pressure and temperature using a mechanical Archimedes screw type device, then forcing the product through a small size hole to define its shape and final characteristics.

The functions of an extruder are mainly feeding, conveying, compressing, cooking, shaping... and with the more sophisticated machines: macro and micro-mixing, venting and cooling. Product expansion is due to the water flash off caused by the pressure difference as the product exits the die.

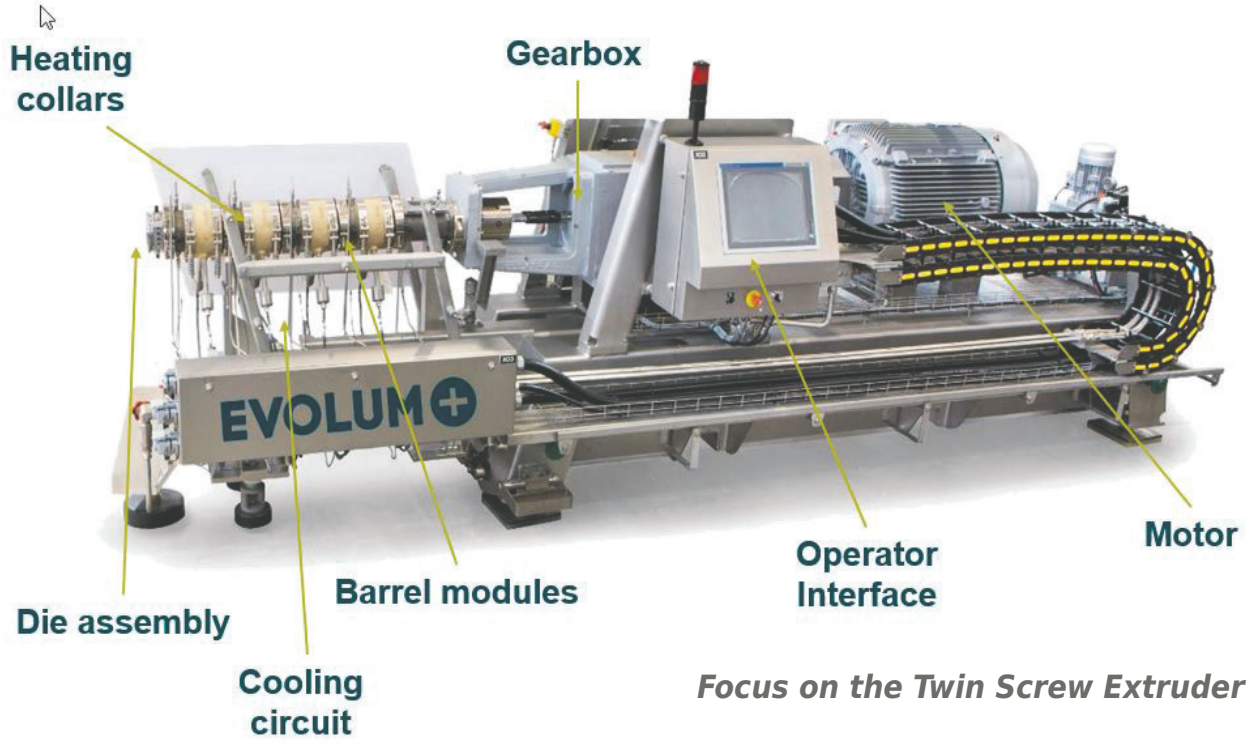


Expansion Process

Twin Screw and Single Screw Extruders

A single screw extruder (SSE) comprises one Archimedes type screw which aims at conveying, compressing and transforming a powdered mixture into a hot dough before pressing it through the die, where shaping and the expansion process take place. The mass conveyance depends on the friction coefficient between screws and cylinder.

A twin screw extruder (TSE) is equipped with two intermeshing screws, generally co-rotating for food and feed applications. The two screws are designed so that the tip of one screw wipes the flanks and root of the other screw, and inversely. The screws are self-cleaning and conveying the mass does not rely on friction.
This configuration generates an intensive mixing effect, efficient heat transfer and achieves a complementary pumping action.



Focus on the Twin Screw Extruder (TSE)

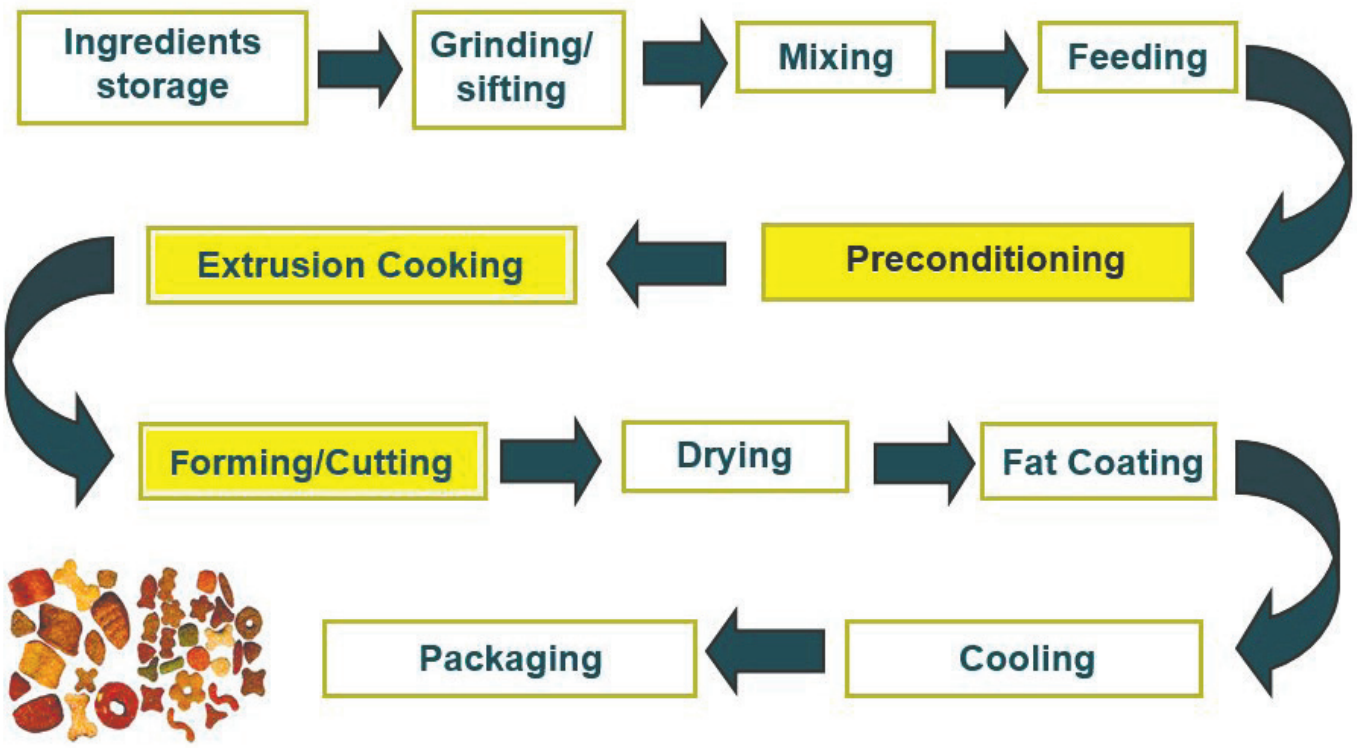
How does the TSE work ?

The TSE enables mixing of the ingredients with added liquids and steam (if needed). It controls the degree of cooking of the dry mix, the shear applied to the processed mass, adjusts the temperatures accurately along the barrel assembly: these features allow the pet food processor to meet the strictest requirements in terms of texture, shapes and expansion for the final kibbles and treats.

Due to the intermeshing screw action, the TSE is an ideal tool for high fat / high moisture recipes. It also offers great flexibility and quick changeover for innovative recipes with specific profiles, fulfilling needs of the growing market in premium pet food and treats.
Additional features include sophisticated process intelligence, hygienic design, and automatic opening of the barrel assembly for simplified cleaning and maintenance.

CONTROL OF THE PRODUCT QUALITY

The complete pet food production line involves many operations starting from raw ingredients up to the packaging process.



However, **preconditioning, extrusion and die-shaping/cutting count among the most important unit operations** in achieving premium quality.

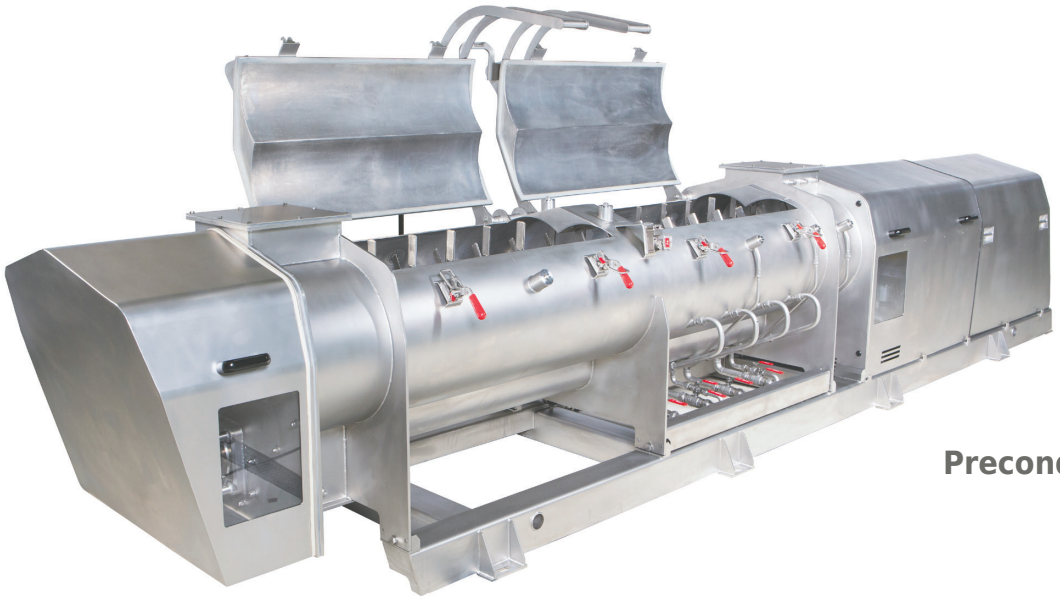
Preconditioning

Preconditioning is a key operation aiming at:

• Homogeneously mixing the dry ingredients with liquids and gas; mainly water (alternatively oil) and steam.

• Moistening and heating the mix to begin cooking the starch, expanding the flour particles, and denaturing the proteins prior to extrusion processing.

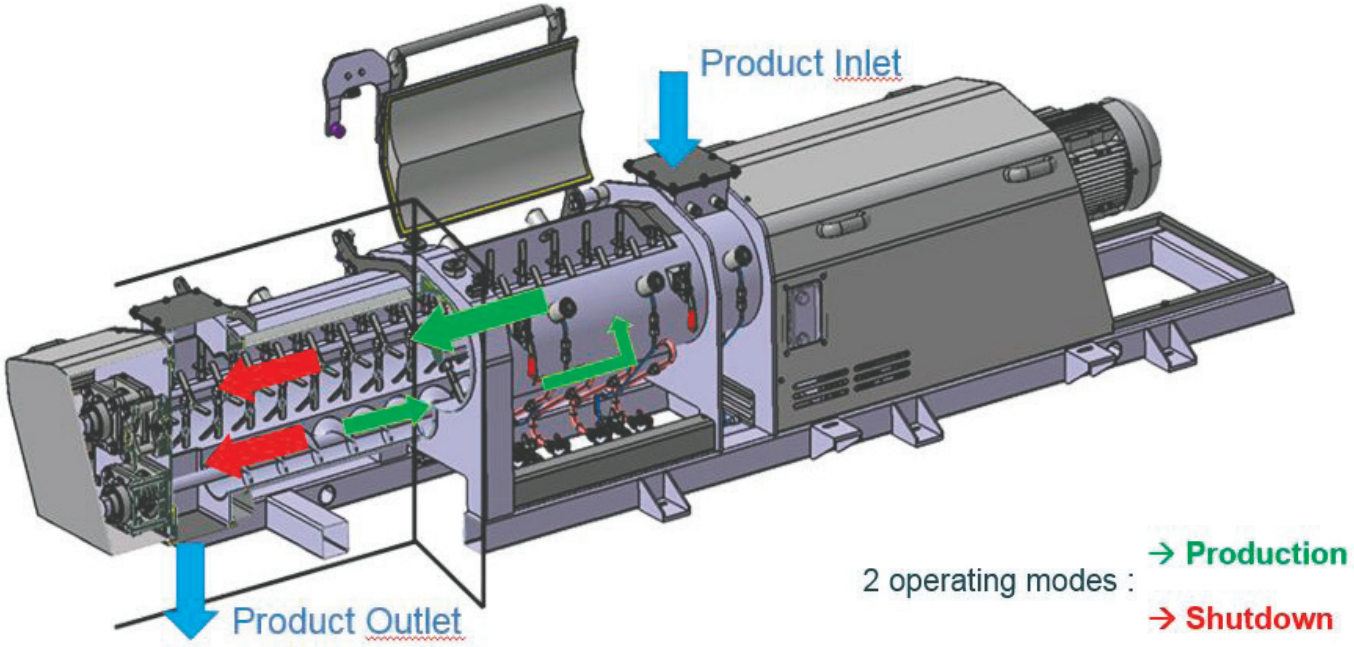
The preconditioning step benefits the overall pet food manufacturing process by increasing the transferred thermal energy in the mass, reducing the mechanical energy into the extruder, increasing the extruder capacity and control of the final pet food texture (bio-polymer tridimensional complex); finally, preconditioning can minimize the extruder wear.



Preconditioner+

Some preconditioners offer high process flexibility due to their patented features. Clextral's AFC technology (Advanced Filling Control) for example, controls the filling ratio and the transfer speed in order to maximize mixing efficiency and regulate the residence time according to each recipe.

Additionally, the AFC bottom screw design allows quick and easy access and cleaning, meeting the strictest hygienic requests and increasing flexibility of the line by enabling quick recipe changeover.



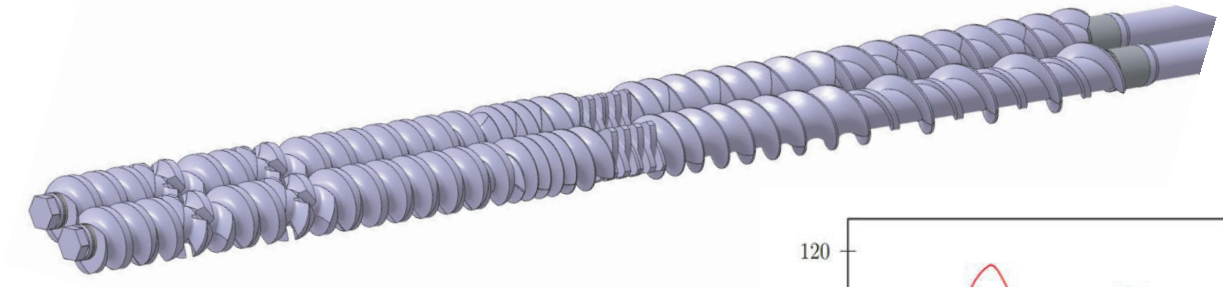
FRESH MEAT ADDITION IN THE PRECONDITIONER

This equipment is an excellent mixer, particularly when equipped with the AFC bottom screw. The injection of fresh meat (emulsion at around 75 % Total Moisture) is possible at up to very high levels (for ex. 30% w/w), compatible with the physical transport of the mass and according to the recipe. (fulfilling requirements of product Premiumization, p.4).

Extrusion Cooking

A twin-screw extruder is particularly well-suited for premium pet food manufacturing as well as treats.

Due to the intermeshing screws with modular screw patterns, a TSE can process high moisture/high fat products; the mixing ability enables an homogeneous heat transfer along the barrel assembly: temperatures, mixing and shear levels are accurately controlled, giving to this continuous reactor the highest flexibility possible.



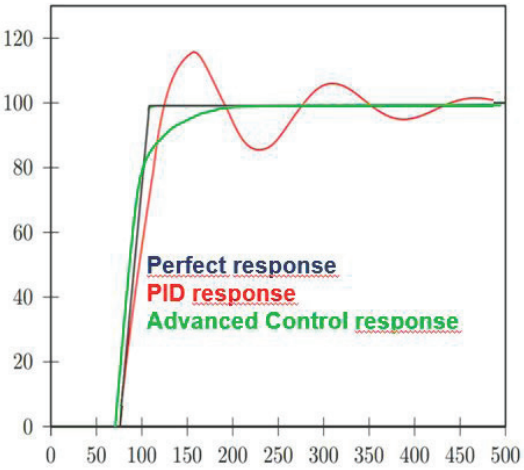
Parameter control

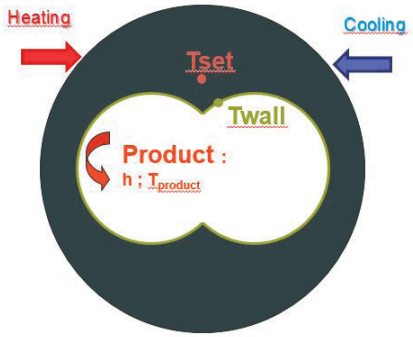
The cooking and the texture of pet foods are controlled by the extrusion parameters such as barrel temperatures, screw-type assembly, screw speed, addition of water and/or steam, and barrel length.

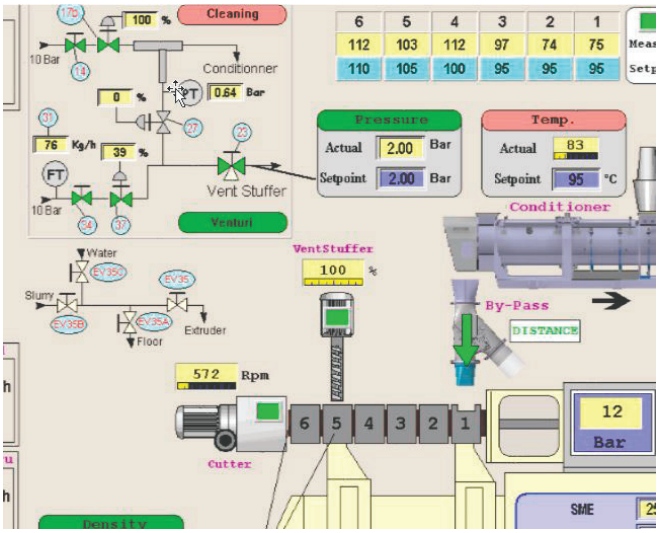
Extruder intelligence

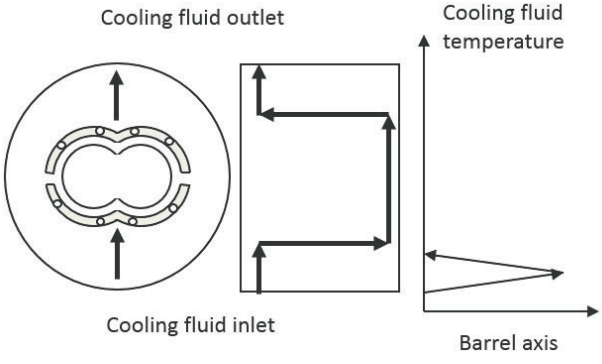
Clextral's Advanced Thermal Control (ATC) provides true intelligence to the extrusion equipment and accurately controls the temperatures in each barrel module with self-learning adjustment, improved response time, enhanced process stability (up to 70 %), and energy savings (up to 20 %).

Density controls may be used as well in some cases to fine-tune the expansion degree and the texture of the final extruded product.









Shaping and forming

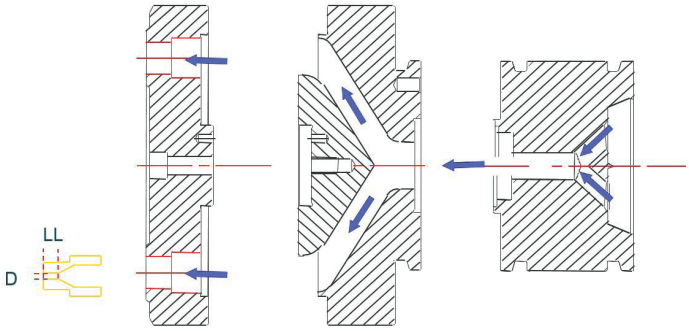
This step represents the final transformation of the cooked dough into a nicely textured and attractive pet food or treat.

The shape is determined at the end of the extruder barrel by a central feed die-plate and a die that give the product its final shape.

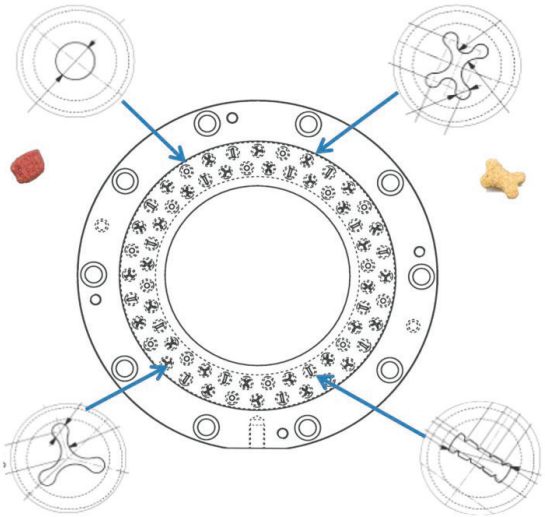
As previously seen, the design of the die will take into account the desired level of expansion of the dough: this last property depends on dry mix recipe, treatment in the preconditioner, the shear-temperature history in the extruder and the design of the die itself.

Great expertise is hidden in the design of the die, its metallurgy, mounting ability for quick changeover and cleaning.

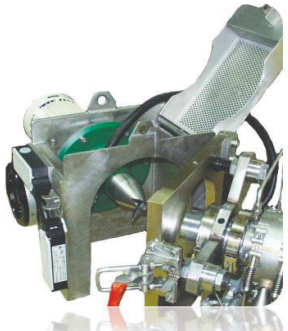
Cutting is considered as part of final shaping and its technology must comply with fine adjustment and accurate parallelism towards the die, no generation of fines, sharp cutting and proper evacuation of the kibbles preserving their shapes and texture.

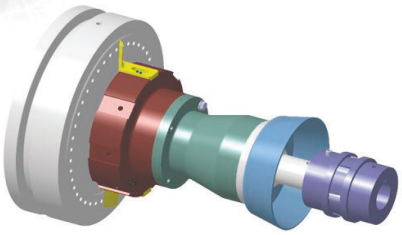


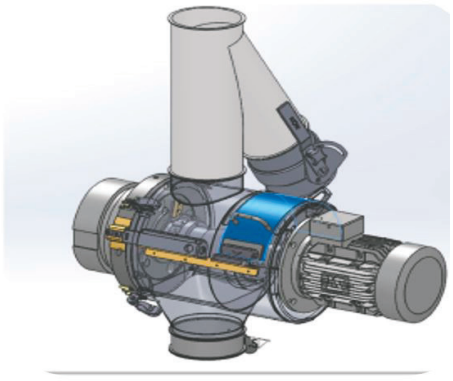
In the barrel



4 shapes in 1 die







Cutting Devices

CONCLUSION

Today premium pet food and treats are key growth-drivers that require highly flexible, reliable and hygienic devices, those being represented by twin-screw extruders.

New developments such as easy and quick access to the screws and barrels, hygienic design, intelligent process control, automated start-up and shut-down operations, are now available to help manufacturers to turn their projects into profitable activities and provide appetizing and nutritionally-adapted foods to all of our animal family members.

Twin Screw Extrusion technology is considered a leading process solution to meet the demands of ongoing worldwide growth of pet food and treats. Its efficient continuous cooking and shaping ability enable manufacturers to successfully compete in this dynamic market.

Services and process know-how from the technology providers, premium metallurgies for screws and barrels, reduced maintenance features, worldwide technical and process assistance are key issues for success and long lasting partnerships.

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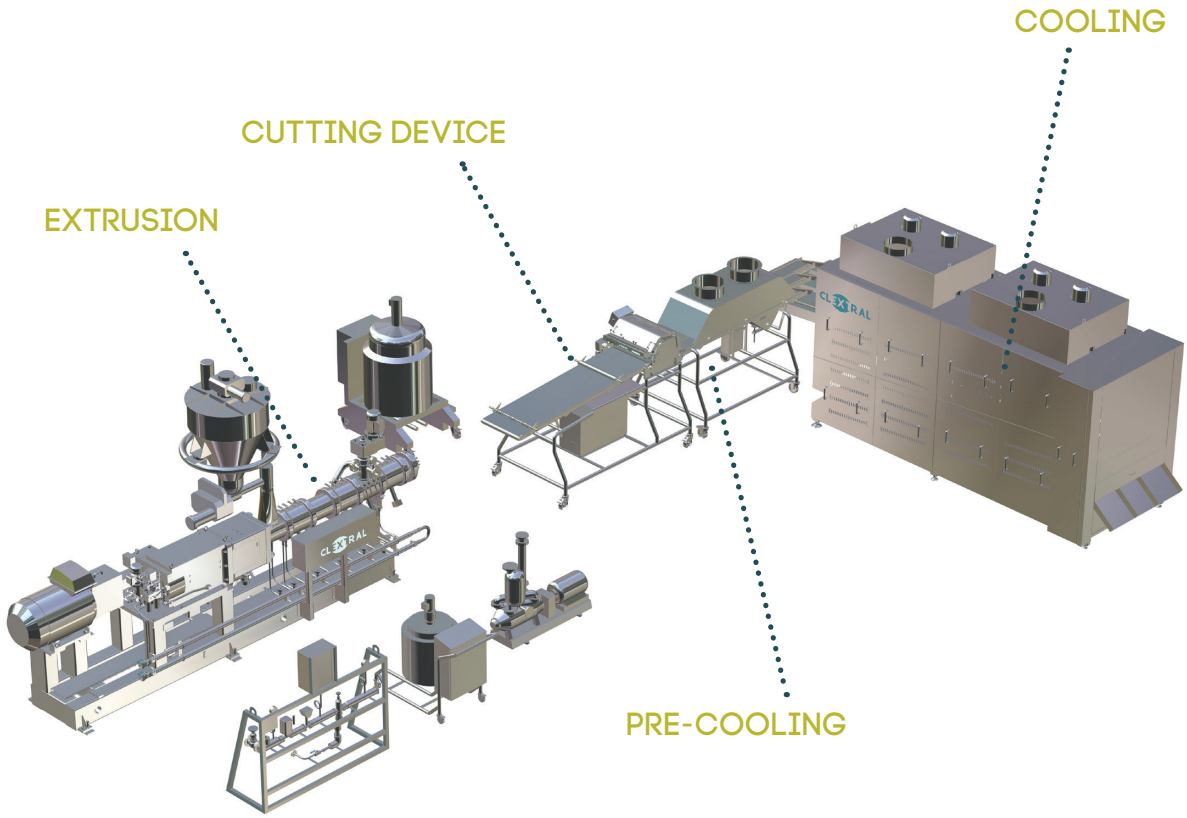

Treat Manufacturing Line with Twin Screw Extruder

Clextral, a leader in twin-screw extrusion technology, assists pet food and treat processors with innovative and cost-effective processing tools. Clextral's technology is designed for maximum versatility and productivity through product and process flexibility, precise process control with advanced automation and intensified processing.

Pet food producers can control all process parameters to tailor products for individual animals: crispiness, degree of hardness or chewiness, size, shape, moisture content, and flavor to boost consumer appeal.

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