The Extru-Technician

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PART 2: The Process Impact of SPECIALTY PROTEINS IN PET FOOD

WELCOME LETTER

WELCOME, AND THANK YOU FOR YOUR CONTINUED INTEREST IN THE EXTRU-TECHNICIAN.

» This issue continues the focus on specialty proteins and their impact on the complete pet food manufacturing process. Extru-Tech's Research & Development Manager, Will Henry, will conclude his discussion of the various specialty proteins used in the industry today.

This continuation focuses on the functions specialty proteins bring to the products, and we further explore the ongoing challenges these proteins may bring to points of the entire production process. Specifically, we will touch on the impact of proteins on cooking, drying, cooling and coating.

As always, we hope you find this issue of The Extru-Technician informative as we share our expertise and experience regarding specialty proteins for pet food and the effect they can have on the overall product and manufacturing process.

Please continue to share your comments and thoughts with us; we appreciate the feedback and look forward to offering solutions.

Sincerely,

Rachel Cardwell
Marketing Director

The Extru-Technician brought to you by **Extru-Tech, LLC**

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PART 2

The Process Impact of SPECIALTY PROTEINS IN PET FOOD

Understanding protein functionality and interactions with drying and plant design

By Will Henry, Extru-Tech Research & Development

Proteins have been a major focus of the research we conduct in our pilot facility in Manhattan, Kansas. Through our trials, we have learned much about using various proteins in pet food products like kibbles, treats and supplements, and how different protein types call for changes in handling, cooking, and formulation.

This is the second article in our "The Process Impact of Specialty Proteins in Pet Food" series. In our last issue, we discussed the importance of considering the impact of the protein ingredient on each step of production and how the protein ingredient interacts within a given diet. We also provided general characteristics and handling requirements for different types of proteins, including fresh and dehydrated meats, vegetable proteins, egg products, whey and casein, gelatin and collagen, and short-chain peptides.

Not all these proteins are new within the pet food industry. Many have been used for years as a protein boost in other industries. The difference is that, now, they are being utilized in new ways

This grain-free, complete diet includes 50 percent fresh meat and is texturized to replicate the appearance and texture of natural fresh meat.

and for different types of products, primarily with treats, dental chews and supplements.

In this issue, we dive in further to specialty proteins by exploring:

- What functions protein ingredients bring to the product
- How specialty proteins affect processing considerations, including cooking, drying, conveyance, cooling and coating

The focus is not only on kibble. We will also consider treats that run the entire gamut of properties and textures, including crunchy and semi-moist.

Functions of specialty proteins

With their unique ingredient stack, specialty meat-add products introduce new challenges and opportunities when it comes to functional attributes. Here, we focus on durability and structure.

➥ Durability is key

Grain-free diets, high-fresh-meat diets, and many other specialty diets remove starchy ingredients like corn, wheat and rice that inherently offer good durability, structure and/or expansion. Exclusionary-type diets like a keto or low-carb pet diet, also typically eliminate these ingredients as they seek to bring carb levels down as far as one gram or less per serving.

In these cases, manufacturers need to leverage the functionality of proteins for durability. In the first part of this series, we discussed the binding properties

This dental stick is produced by utilizing a single-screw extruder, a mid-barrel valve, and our advanced densification unit (ADU) to achieve optimal texture and durability.

of egg-type products, plasma, gelatin, and short-chain marine peptides. These also enhance durability. However, it is usually best not to isolate an ingredient deck to just one binding source; most formulations require a good mix of proteins with different, complementary properties. This can prevent problems like caking and bridging during the manufacturing process. Additionally, if an ingredient deck is substantially stacked with a single ingredient, then this typically leads to a more unstable process. Adjusting proteins to the right levels will ensure adequate durability and hardness.

➥ Bite structure and texture

Treats and semi moist treats, whether training treats or functional treats like a dental chew, become even more challenging because they require a much wider range of bite characteristics.

For example, a dental chew designed to be consumed in one sitting may require a two-minute chew time, which would require a certain set of specialty proteins such as collagens to acquire that set texture. On the other hand, a 15-minute chew time may use similar proteins but require both a different ratio of the proteins, as well as some difference in processing to activate the hardness and make the chew last longer.

In short, proteins can be used to create a diverse selection of texture and bite characteristics, with different proteins offering different effects at different points in the process.

Processing considerations

The specialty proteins you choose for your product, their attributes, and their quantities and ratios all dictate how you operate the equipment, and may even require new configurations in the plant.

➥ Changes at the preconditioner and barrel

For many of the functional protein supplements, the preconditioner is simply used as a mixer,

This treat is made with real peanut butter and banana, and it's texturized using a novel short-chain protein for enhanced appeal and texture.

with no steam and a high speed to get ingredients through quickly to prevent cooking. Then, they are run slowly down the barrel with low pressures, low shear, and just enough die pressure to form the product.

For example, functional ingredients such as chondroitin that offer very specific benefits in the animal must have their structures preserved in the manufacturing process. Running them through a typical extrusion process with high shear and high energy will destroy their functional components. This calls for a set of compatible proteins that will bind the ingredients at low energy and low shear, such as short chain proteins, which do very well preserving durability of the product and survivability of the functions with a gentle cook.

This is only one piece of the larger puzzle of handling proteins to optimize their functionality. A crucial part of this picture is understanding when and how different proteins work so that they are activated at the right time in the process. For example, egg products activate with heat. If you activate the egg proteins too soon in the process (for example, during preconditioning or early in the barrel), the egg turns sticky and very hard to work with. It will lead to surging and inconsistent product. The product also loses durability, because the proteins are cooked and can no longer perform their binding function or provide internal texture and expansion when it is needed—right at the end of the extrusion step.

On the other hand, gelatin is a cold-set binder that has little impact on the product until it cools below about ~130°F. At that point, the gelatin starts to set, helping with binding and durability. Depending upon how hot the dryer runs, gelatin may not truly set until the product is in the dryer or, sometimes, even out of the dryer.

Plasmas and hydrolyzed plasmas have both hot-set and cold-set properties and offer a chewy texture to treats and kibbles. They start to bind in the barrel, affecting viscosity and helping with expansion and binding at the die. Once the product is on the cooling conveyor, it can be further manipulated with cutting or slicing before it completely sets.

➥ Drying considerations

With specialty protein products, drying times and methods change drastically from standard pet food or even standard treats. Typically, as protein goes up, fat content also goes up. This can lead to inaccurate moisture sample readings if you fail to take into account that fats are being volatilized during typical moisture analysis procedures.

Drying efficiency fluctuates significantly with high meat, premium, and grain-free diets. The

direction of efficiency is directly impacted by the ingredient deck. For example, if we have a high-meat diet that is comprised of fresh meat, meat meals and cereal grains, then the drying efficiency is good.

On the other hand, vegetable proteins are more hygroscopic. They hold on to moisture, ending up with drying curves that are longer. This leads to real challenges when mixing vegetable proteins with temperature-sensitive binders prone to toasting and scorching.

Whole potato and potato protein isolates are common examples of binders that are reactive to high dryer temperatures. They quickly produce a color change and, if the dryer runs too hot, the product becomes more brittle and starts to lose durability.

➥ Effect of plant design on processing

The biggest challenge we see in today's facilities is that, when many were built ten or fifteen years ago, there was less consideration for specialty-type products. These products are often more prone to breakage and need gentle handling on the way to drying and packaging to prevent loss. Choices are to:

- Fortify the formula with the specialty binders to overcome shortcomings in the plant design;
- Or alter the plant design and process to allow gentler handling.

We discussed increasing durability through formulation in the previous sections. In this section, we will evaluate adjustments to plant design and processes, particularly:

- Dry blend handling
- Switching to mechanical conveyance from the die to the dryer inlet
- Adjustments to the cooling and coating processes

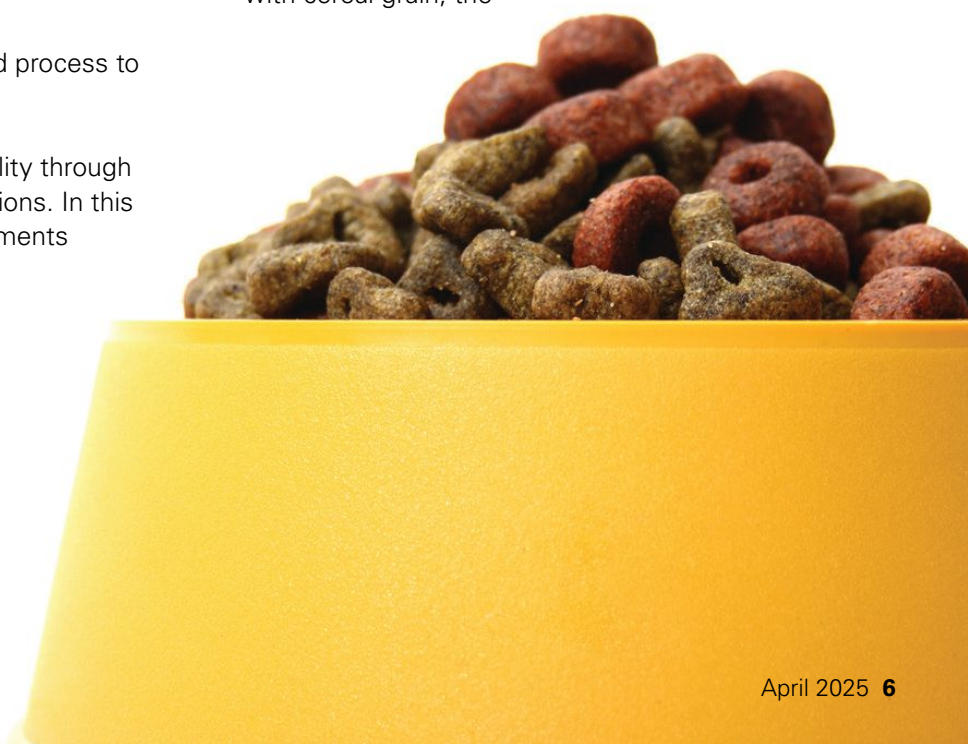
➥ Loss and weight handling

With regard to dry blend handling, adjustments to bin agitation may be needed to compensate for the specifications of some high-protein diets and the unique attributes of specific ingredients. For example, high-fat ingredients like powdered egg can contribute to caking and bridging issues depending on the set up. Manufacturers should ensure all transitions are free and clear, with nothing for the ingredients to build up on.

➥ Mechanical conveyance

We also need to look at conveyance—how we move the product from Point A to Point B, how we move it from the die to the dryer, and how we move it from the dryer to coating or cooling. A pneumatic conveyance system with multiple 90-degree turns that handles traditional formulations perfectly can lead to massive breakage and loss with more fragile specialty formulations. Mechanical conveyance allows greater leeway in product structure than pneumatic conveying. Simply drop the product onto a conveyor and take it up a lift to the dryer. The product needs less fortification to maintain durability, allowing much more flexibility on the ingredient deck and on finished product shape, size, and other specifications.

I increasingly see plants set up for both pneumatic and mechanical conveyance. When running a standard product with cereal grain, the



operator can swing the hood in and carry it up pneumatically. Then, when they switch to a more complex product, they swing the hood out and away and drop the product onto a conveyor.

The key with mechanical conveying—and it is just as critical with pneumatic—is keeping the system clean and protecting the process from cross contamination. Options for abatement include using covered conveyors, having a set cleaning procedure, and installing automatic cleaning units. Deciding how to deal with cleaning and sanitation is a critical aspect of installing any new system.

➥ Final steps

No major changes are usually required in the cooling process with Extru-Tech systems, since discharge temperature and fat levels are being monitored to inform cooling parameters. The only thing manufacturers may want to consider is not running such a high level in vertical coolers on some of the weaker products, since this could contribute to crumbling. In addition, some specialty protein formulas that are less durable require a gentler coating process.

At Extru-Tech, we are dedicated to our customers and helping them create products that meet the needs of today's pets and their owners. We help them perfect specialty meat-add products with the Aseptic Dual Preconditioner and the Next Generation Single Screw Extruder with its Energy Management Valve, Mid-Barrel Valve, and scientifically validated SSOP. We look forward to partnering with you in creating products that merge market needs with innovation.

See you in the next issue of *The Extru-Technician*!

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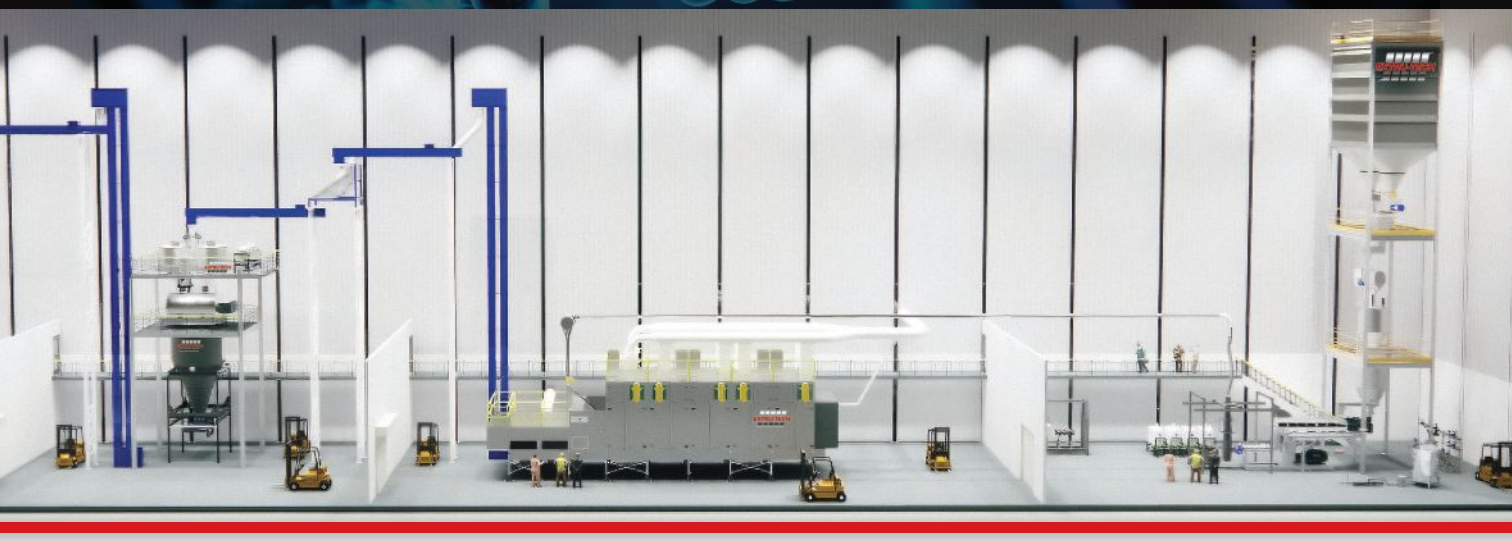

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