

The **Extru-Technician**

EXTRU-TECH
INC.

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**LIMITED
INGREDIENT DIETS:
EXTRU-TECH IS UP TO
THE CHALLENGE**

WELCOME LETTER

THE EXTRU-TECH SOLUTION FOR LIDS

Welcome, and thank you for your continued interest in *The Extru-Technician*. As the market popularity of dry expanded, limited ingredient pet foods—or more commonly known as LIDs (limited ingredient diets) in manufacturing circles—continues to increase, we have focused this issue on the unique extrusion-related manufacturing challenges and solutions associated with these formulas.

Creating extruded dry expanded LIDs as safe, attractive, and durable kibble requires tight control of the extrusion process profile. This process profile control is readily accomplished using an Extru-Tech single-screw extrusion line architecture. Further, if you currently operate an Extru-Tech extrusion line to manufacture your standard pet food diets, with minimal system adjustments you can create a variety of LIDs

from a wide range of proteins and plant-based components. This is just another example of how your original investment into an Extru-Tech Inc., solution can be easily adapted to current and future market demands.

As always, we hope you find this issue of *The Extru-Technician* informative as we share our expertise and experience with our loyal clients and readership.

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

Sincerely,

R. Scott Krebs
Executive V.P., C.O.

The **Extru-Technician** brought to you by **Extru-Tech Inc.**



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LIMITED INGREDIENT DIETS: EXTRU-TECH IS UP TO THE CHALLENGE

More than ever, today’s consumers view their pets as part of the family. Just like parents want the best food for their children, pet owners want the same for their animal companions.

Because of this, consumers are increasingly turning to limited-ingredient diets (LIDs) for pets. As the name indicates, these diets use a limited number of food sources in their formulation while providing for the animal’s nutritional needs. This greatly simplifies the ingredient deck.

What constitutes a LID?

There is no standard definition for what constitutes a LID, but trends can be detected as they become more popular. Typically, pet foods marketed as LIDs use two food sources—either an animal source with a grain source, or an animal source with a vegetable source—to make up 85 to 90 percent of the formula. Each source may have several constituents. For example, a duck-and-pea diet could incorporate duck meal in addition to fresh duck, and pea starch or pea fiber in addition to

field peas. The rice portion of a salmon-and-rice diet might include white rice, brown rice, brewer’s rice, and rice starch. The remaining portion of the diet may include vitamins, minerals, palatants, and preservatives.

LIDs do not have to be grain-free, but since many consumers seek out grain-free foods for their pets, manufacturers often choose to combine this genre with at least some of the LIDs they offer. Other label claims that frequently cross over with LIDs include organic, all natural, and ketogenic.

Manufacturing LIDs—whether grain-free or not—can pose significant challenges. Fortunately, Extru-Tech has a depth of experience working with manufacturers to produce high-quality LIDs that meet animals’ nutritional requirements and pet owners’ expectations.

What nutritional challenges do LIDs pose?

Pet food manufacturers usually rely on the complementary nutritional profiles of multiple ingredients to produce nutritionally complete diets containing optimal levels of more than forty-five nutrients. These simply are not found in any single ingredient. Limiting the number of ingredients makes it more difficult to achieve the proper balance, particularly with respect to essential amino acids and fatty acids.

“Formulating an LID recipe may seem like it should be easier than a food that uses more ingredients. However, less doesn’t always mean easier,” says Greg Aldrich, PhD, and president of Pet Food & Ingredient Technology Inc. and

Limited ingredient diet (LIDs) typically include...		
One animal source	One plant source	
	Grains	Vegetables & non-grain starches
Forms may include fresh meat, dry meat, animal meal, organs, etc.	Forms may include cooked whole grains, flour, starches, bran, and grain protein	Forms may include fresh, dehydrated, starches, and isolates
Examples: <ul style="list-style-type: none"> • Venison • Beef • Salmon • Duck • Chicken 	Examples: <ul style="list-style-type: none"> • Rice • Wheat • Corn • Sorghum 	Examples: <ul style="list-style-type: none"> • Sweet potato • White potato • Peas • Tapioca • Soybeans • Carrots • Spinach

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a research associate professor in the pet food program at Kansas State University. “Swings in composition of any one ingredient have a more profound effect on the outcome.”

Aldrich gives the example of a recipe from fishmeal and potatoes that has a lysine content on the low end of the acceptable range. If a particular lot of fishmeal has a lower-than-average protein content, the lysine content could drop below the required level.

Changes in ingredient composition can also affect processing. For example, the moisture and fat content of raw meat might vary from lot to lot. When the moisture and fat content are higher, they impact the effects of thermal energy added to the extruder barrel. They can also inhibit expansion of the kibbles, resulting in a denser final product that has higher nutrient and caloric counts per unit of volume, but still has relatively low portions of protein compared to fat and carbohydrates. This can lead to further nutritional imbalances.

Manufacturing LIDs is “no easy feat without the right tools,” says Aldrich. Those tools include taking extreme care to assure the quality of all ingredients, making adjustments in the manufacturing process to compensate for variations in ingredient lots, and verifying the final product. Extru-Tech can help manufacturers with each of these steps. While the concept for a “limited ingredient diet” might sound like a simpler solution the reality is far from it.

What are the possible manufacturing challenges of LIDs?

Manufacturing pet foods takes the skill and awareness of a juggler. Key to creating top-quality LIDs is understanding and compensating for the challenges their ingredients pose. Each aspect of the manufacturing process is one of several balls moving through the air. You need to keep an

eye on all the balls at once and make sure they move in tandem. Dropping one ball can lead to the whole process falling apart.

Challenges that every manufacturer must juggle when creating a LID include:

- Increased sensitivity to thermal energy
- Increased sensitivity to mechanical energy
- Increased sensitivity to moisture variations
- Decreased ability to absorb moisture
- Finished product density

When food safety is involved, manufacturing might even be compared to juggling with swords. One mistake can spell disaster. On the other hand, experience, competence, and an understanding of the many processes involved in pet food creation can not only thwart danger, but ensure success. When you get all the “balls” synchronized, the result is perfection.



The experts at Extru-Tech understand pet food manufacturing inside and out. Relying on this expertise, they have worked with a number of manufacturers to develop processes and machine settings for creating top-quality LIDs.

Below, we outline some of the manufacturing challenges that Extru-Tech has helped its customers overcome.

Increased sensitivity to thermal energy

Thermal energy comes into the manufacturing process at several points; for example when, steam is added to the barrel or when friction in the extruder produces heat. Increased sensitivity to thermal energy poses its biggest challenges in the extruder, though it can come into play in the preconditioner as well. Almost any type of product with a limited ingredient deck will have increased sensitivity to thermal energy, because specific ingredients have their own strengths and weaknesses.

Some ingredients are particularly sensitive to sudden bursts of heat, while others may degrade with prolonged heat exposure. Tubers and rice, for example, tend to be sensitive to a high concentration of thermal energy applied all at once. They may get clumpy or sticky, making it difficult to distribute them throughout the LID mix. Or they may not cook evenly.

Unfortunately, when formulating a LID, you can't balance out a "sticky" starch by incorporating one that has less tendency to clump. One solution would be to reduce the temperature used to cook the product, but that isn't always possible. Minimum heating requirements must be met in order to eliminate pathogens and render ingredients more digestible. Sacrificing food safety to create a nice-looking product is not an option.

But you can account for the peculiarities of a given ingredient in the manufacturing process. With the rice example above, applying heat at a

more gradual rate is one approach to help ensure a quality final product. Extru-Tech has developed myriad solutions for LIDs' sensitivity to thermal energy, each one unique to the ingredients and recipes involved.

Increased sensitivity to mechanical energy

Mechanical energy comes in the forms of friction, compression, and stretching that happen during ingredient mixing and extrusion. The high air pressures used in pet food manufacture are another source of mechanical stress. Mixing ingredients too heavily, too quickly, for too long a period, or under too high a pressure can cause them to degrade.

Possible solutions include reducing the intensity of mechanical energy while letting ingredients mix for longer periods, or even reducing the amount of time spent in the extruder, if appropriate. As always, food safety comes first.

Fine-tuning the proportions of ingredient subtypes can also help. For example, when using rice in a LID recipe, it may help to alter ratios of brown rice, white rice, rice flour, rice bran, and rice protein—or to add or subtract one of these ingredients—since each ingredient subtype reacts to mechanical energy in a different way.

Increased sensitivity to moisture variations and decreased capability of moisture absorption

Grains like wheat, sorghum, and corn are often used in pet foods to control excessive moisture and help ingredients cohere. Compared to popular LID ingredients such as rice and peas, they are able to absorb more water during the manufacturing process, to hold post-extrusion coatings, and to help finished kibbles stand up to humidity.

Removing wheat, sorghum and corn—and their derivatives—from the formula can pose significant challenges in manufacturing. Cooking usually involves adding moisture at various steps, either in the form of steam or water. Pet foods made with

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these cereal grains can typically handle moisture fluctuations of 2 to 4 percent during the manufacturing process without affecting the final product.

LIDs made without these grains, on the other hand, may only be able to tolerate fluctuations of 0.5 percent or less. This is partly due to the higher oil content in some plant ingredients. Just like oil and vinegar will naturally separate in a jar of homemade salad dressing, oily plant/animal ingredients have a tendency to be anhygroscopic, or to repel moisture. This is critical in that the cooking process requires a homogeneous distribution of moisture to ensure stable production of quality product.

Nonetheless, many consumers demand LIDs without wheat, sorghum, or corn because of perceptions regarding what is natural for an animal to eat. Thankfully, producing a high-quality LID without these cereal grains is possible when manufacturers understand their ingredients and

their machinery, and when they carefully monitor and tightly control moisture levels throughout the manufacturing process.

Looking at ingredients, one of the biggest sources of moisture in pet food production—particularly high-protein diets—is fresh meat, which naturally contains about 70 percent water. Cooking can cut moisture by up to one-fifth, which can be partially achieved in the preconditioner. But this still leaves moisture levels above 50 percent. In LIDs, balance can come in the form of dehydrated or freeze dried meats from the same animal species as the fresh meat. Dried vegetable or grain meals are another way to level the moisture ratios.

Moisture variations also come into play in the dryer, since LIDs tend to dry at different rates than standard diets. Adjustments in air velocity, temperature, volume, or bed depth will affect how much product can be run through the dryer during a given amount of time and whether it dries evenly.

Finished product density

Less of a manufacturing challenge than a marketing one is the fact that LIDs tend to be denser than standard dry pet food, which typically weighs 18 to 26 pounds per cubic foot for average pet foods. Just as popcorn expands and becomes fluffy when cooked, the grains present in most pet food give pellets a lighter texture by helping them to puff up as they cook and dry.

Vegetables and meat do not expand in the same way, so LIDs can be one-and-a-half times as dense as standard formulations. Put another way, the same amount of food by weight will take up a third less space. If you put it in a bag sized for standard pet food,



Canine ME One



Feline ME One



Canine TE One



Feline TE One

the bag will be only two-thirds full, and consumers might worry they aren't getting a good value for their dollar.

Therefore, it's important to design packaging and labels after the LID has been formulated. Extru-Tech can help you perfect your LID recipes at its pilot facilities so when the time comes to work on packaging, you have all the weight and volume specifications you need.

Conclusion

Meeting the challenges posed by LIDs can seem complicated, but ultimately it comes down to selecting the right tools for the job. Will Henry, research and development, Extru-Tech Inc.,

compares the process to the familiar endeavor of home baking. "I love to cook for my family, and having a stand mixer makes everything easier. If I want to make pizza dough, I attach a dough hook and go. If we're baking a cake, we use the heart paddle." Just like stand mixers have specialized configurations for each type of dough or batter, the pet food manufacturing setup needs similar adjustments for different types of ingredients.

Through testing and process development at its pilot facility, Extru-Tech helps manufacturers determine the optimal configurations for making LIDs. For more insight into LIDs and their formulation, contact your Extru-Tech representative.

The Extru-Tech

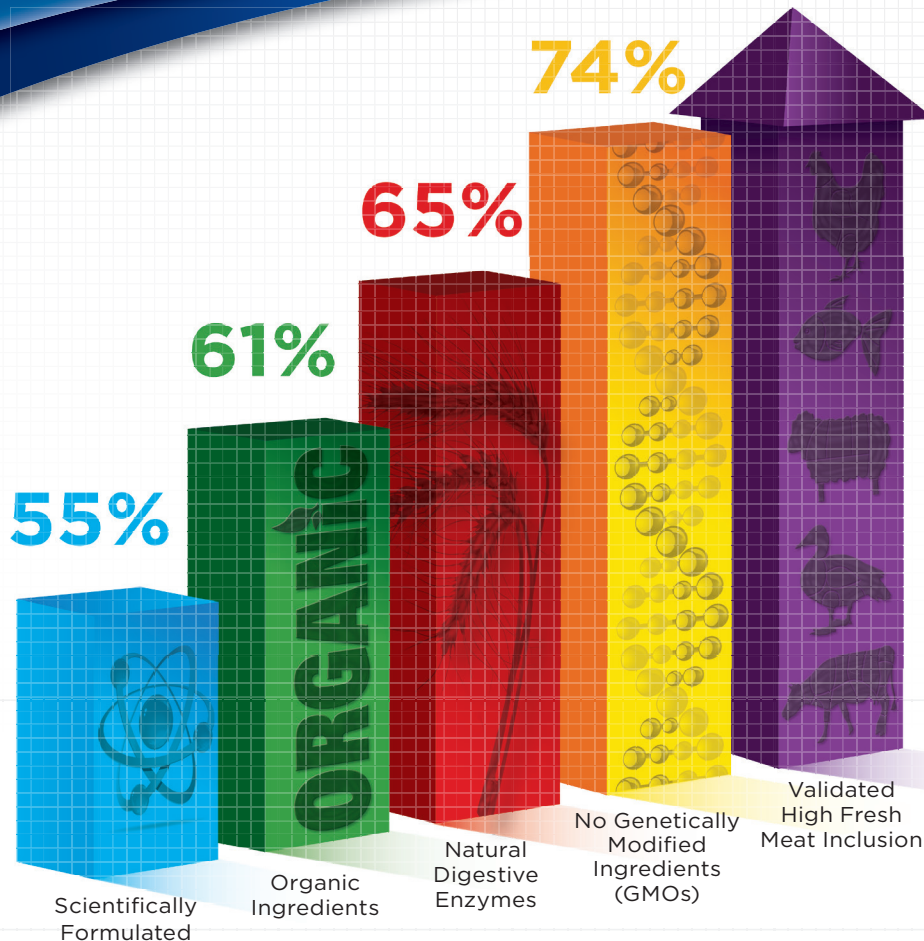
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We Are Witnessing the Humanization of Pet Food



**Data derived from a choice-based exercise in which participants are asked their preference for one concept over another. The percentages above represents the number of times that a concept displaying each claim was preferred over its paired concept out of the total number of concepts shown with that claim.*

“As pet owners migrate toward pet foods with more humanization traits, manufacturers that can safely incorporate fresh meats and high proteins will have the strategic advantage. As an extrusion manufacturer with a Validated Kill Step, partnering with Extru-Tech will give you that advantage.”

– Scott Krebs, Executive VP, COO

Contact Extru-Tech today at 785-284-2153 or visit us online at www.extru-techinc.com.



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