

# The **Extru-Technician**

November 2016

[Extru-TechInc.com](http://Extru-TechInc.com)

## THE TIES THAT BIND

A brief of what holds dry  
pet foods together



# WELCOME LETTER

## WHAT HOLDS PET FOOD TOGETHER?

Welcome, and thank you for your continued interest in The Extru-Technician.

In this issue, the discussion will target the various types of “binders” and their uses as they pertain to the extrusion of dry-expanded companion animal diets. We will begin by defining what constitutes a binder, and then offer brief insights into their origins, macronutrient profiles, and the different categories of binders.

As the extruded kibble companion animal food industry migrates to higher inclusion levels of fresh, raw, animal-based proteins (meats), the issue of binding this blend out of the extruder into a safe, attractive, and durable diet requires the most technological advanced solutions. Clients are creating a variety of ultra-high-meat, grain-free, low-carbohydrate, limited-ingredient, and ketogenic diets from established components such as fresh chicken, eggs, tapioca, peas, salmon, and sweet potatoes. These are all possible using the same Extru-Tech single-screw extrusion line architecture with little or no

equipment investment or system changes, and just a few minor process alterations.

As always, we hope you find this issue of The Extru-Technician informative as we share some of our expertise and experience regarding how binders function and the attributes they bring to the final cutting-edge products, and crucial advancements for your companion animal products.

To learn more about pet food manufacturing from start to finish, check out our “Extrusion Seminar in Petfood and Aquaculture,” December 7–9, 2016, in Ensenada, Baja California, Mexico, at Petfood Forum Mexico.

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.O.  
Extru-Tech, Inc.

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



#### CORPORATE OFFICE

PO Box 8, 100 Airport Road, Sabetha, KS 66534  
+1.785.284.2153 Tel +1.785.284.3143 Fax  
extru-technician@extru-techinc.com  
www.extru-techinc.com

#### ADMINISTRATIVE STAFF

**LaVon Wenger** President/CEO  
**Don Wenger** Executive Vice President  
**R. Scott Krebs** Executive VP/COO

#### EQUIPMENT SALES STAFF

**Bill Huseby**  
Director of North America Sales  
billh@extru-techinc.com +1.913.522.9014  
**Bob Annan** Director of European Sales  
boba@extru-techinc.com +1.785.284.2153  
**Oswaldo Munoz**  
Director of Latin America Sales  
oswaldom@extru-techinc.com  
+56.2.955.25.74 Santiago-Chile

#### EXTRU-TECH, INC. PART SALES STAFF

**Darryl Becker**  
darrylb@extru-techinc.com  
+1.785.284.2153

**Enzhi Michael Cheng, PhD,**  
Director of Asia Sales  
michaelc@extru-techinc.com  
+1.785.285.0703

**Doug Coverdale**  
Sales Engineer  
doug@extru-techinc.com  
+1.785.284.2153

**Mike Dunlap**  
miked@extru-techinc.com  
+1.785.284.2153

#### MARKETING & EDITORIAL STAFF

**Norm Schmitt** Corporate Sales Manager  
norms@extru-techinc.com +1.785.284.2153  
**Will Henry** Technical Sales Engineer  
willh@extru-techinc.com +1.785.284.2153  
**Rachel Ulreich** Marketing Specialist  
rulreich@extru-techinc.com +1.785.285.8064

**A WATT Global Media/Petfood Industry**  
custom publication

## THE TIES THAT BIND

### A brief of what holds dry pet foods together

Extru-Tech has developed mechanical configurations and process parameters that simplify the extrusion of high-protein pet foods. With these innovations, clients are creating a variety of ultra-high-meat, grain-free and limited-ingredient diets from simple components such as fresh chicken, eggs, tapioca, spinach, salmon and sweet potato. They can use the same Extru-Tech, Inc. single screw extrusion line architecture for creating the premium, standard and economy lines that are essential to their product mix with little or no equipment investment changes and just a few minor process changes. These innovations also allow customers great flexibility in choosing binders.

But to choose a binder, one needs to understand what different binders do and how they perform. In this article, we define what a binder is, how binders work, their macronutrient profiles (either starch- or protein-based), and the four forms of binders that pet food manufacturers work with most often (whole food, food concentrate, food isolate, or engineered binder). We also discuss the decision-making process for determining the most appropriate binder or binders for a particular pet food or pet treat product.

#### What is a binder?

Binders have been used in cooking for millennia. A binder is any ingredient that makes a batter or dough stick together—whether that means lentils or oats in meatloaf, water and flour in bread, or eggs and butter in cookie dough.

Pet food manufacturers follow that tradition by using binders in their own recipes. Binders hold pet food mixes together so they can be formed into kibbles of uniform shape and consistency, and protect against excessive kibble crumbling or mechanical deterioration. Pet owners want something their animals can sink their teeth into, and binders help ensure kibble pieces stay whole until an animal bites into them. Without binders, dry pet food would be nothing more than a bag of crumbles.

#### Binders are food

Just as in human cooking, binders play double duty in pet food. They make batter stick (bind), but they also bring important nutrients and flavors to the mix. The principle macronutrients found in pet food binders are starches and proteins.

#### Starch-based binders

Starches are carbohydrates and are found in plant-based foods, with substantial concentrations in grains, tubers and vegetables.

How does starch work as a binder? In their raw state, starch molecules form a crystalline structure. When starches are mixed with water and heated, these structures expand and break apart. This process frees up the individual polysaccharides, called amylose. These molecules rejoin into a sort of lattice. The starch-liquid mixture grows thick and takes on the properties of a paste, able to integrate multiple ingredients into unified dough.



## THE TIES THAT BIND

Because of these properties, pet food manufacturers have long turned to starch-rich ingredients to give cohesion (binding) to their mixes. Plants vary in the amount of starch they produce, which means that some plant ingredients offer more efficient binding than others.

Typical Starch Contents of Common Cereal Grains*	
Cereal Grain	% Starch (Dry Basis)
Corn	63-73
Wheat	55-65
Sorghum	62-75
Barley	58-68
Oats	61-60
Rice	65-78

Typical Starch Content of Tubers*	
Tuber	% Starch (Dry Basis)
Tapioca (from cassava root)	85-89
Potato	65-78

Typical Starch Content of Vegetables*	
Vegetables	% Starch (Dry Basis)
Pea	17-25
Carrot	25-35
Spinach	11-20

\* These ranges are typical, and will vary depending upon processing nuances, preparation, and geographic location of crop growth.

Grains and tubers usually offer the most efficient binding, followed by vegetables. Examples of grains include rice, wheat, corn and sorghum; tubers include cassava root (the source of tapioca), potato and sweet potato; and vegetables include peas, plantains, carrots and spinach. See tables for the typical starch content of some of these foods.

### Protein-based binders

Starch isn't the only naturally occurring binder available to pet food manufacturers. Many protein sources also make excellent binders, from fresh meat to gelatin. Incorporating these ingredients into pet food is a win-win for manufacturers seeking to create high-protein formulas.

Think about making a hamburger at home. By grinding the fresh meat and forming it into a patty, you expose the protein chains and distribute naturally occurring fat and water throughout the burger (fresh meat is about 70 percent water). Cook it at the right temperature, and these proteins, fats, and the moisture in the meat hold (bind) the burger together without additional ingredients.

If you choose a leaner meat or add ingredients such as chopped onion or mushrooms to the burger, the meat's binding qualities will not be strong enough to unify everything. That is why many cooks add binders such as egg yolks or whole eggs when making these kinds of burgers.

Eggs have multiple naturally occurring properties that make them an ideal binder. Eggs contain proteins called albumins that are spherical when the egg is in its



High Meat 'Shred'  
(40% fresh chicken)



High Meat Canine  
(43% fresh chicken)



High Meat Feline  
(45% Fresh Chicken, 75% of  
ingredients from animal source)



High Protein Insect  
Meal Biscuit



High Meat Canine Limited  
Ingredient Diet (fish and potato)



Spinach & Pea cluster

raw state. But add a little heat and these tightly wound protein molecules uncurl and move around. This exposes their chains of amino acids. As the proteins move, they collide into each other and the amino acids form new chains. With the right amount of heat, the chains form a web that “tangles” (binds) ingredients together.

Lecithin is another component of eggs that helps ingredients mesh. Left to their own devices, oil and water don't mix. To get fat-based and water-based ingredients

to join together, an emulsifier is needed. The lecithin found in egg yolks does just that, while also acting as glue (binder).

These attributes make eggs substantially more efficient than tapioca at holding ingredients together.

Other proteins—such as casein from milk, albumins in plasma, and the collagen proteins in gelatin—have similar binding properties. Each has unique qualities that can bring additional value by improving

## THE TIES THAT BIND

the texture of kibble or boosting moisture. For example, gelatin can help make pellets that are both firm and springy as a pet bites into them.

### Binders come in many forms

When discussing binders, it is common to divide them into categories such as “whole,” “concentrate,” “isolate” and “engineered.” These categories tell something about the form a binder comes in.

- A whole binder is a food that is close to the form in which it appears just after harvest and cleaning. Whole binders would include ingredients such as whole potatoes, fresh eggs, or fresh meat.
- A concentrated binder is a food that has had most of the water removed. Some of the food’s water-soluble compounds, such as certain carbohydrates, may also have been removed with the water. After drying, concentrates may be treated with alcohol, moist heat, or another method to further refine the product. Concentrates may be available as a solution or a dried meal or powder. Examples include whey protein concentrate and dehydrated albumen.
- An isolate is the result of a chemical purification process. For example, protein isolates may be made by treating a concentrate with water and alkali, then an acidic ingredient, to precipitate the proteins. The proteins are then dried into a powder that can be added to food products and mixes.

Whey protein isolate is an example. Pea starch, rice starch, potato starch, corn starch, tapioca starch and other food starches may be considered either concentrates or isolates, depending on the way they were processed.

- An engineered binder is a food made up of one or more concentrates or isolates and may have additional ingredients to enhance its nutritional properties or performance. Engineered binders are usually proprietary and known by their brand names.

Whatever categories specific binders may fall into, they are all foods with their own nutrient and taste profiles. Some are crucial to the palatability of a pet food, while others have a neutral flavor that takes a background to other ingredients.

### Conclusion

Binders have been part of human and pet food manufacturing for decades, and of home cooking long before that. Every pelleted pet food on the market requires binding. Fortunately for manufacturers who want to differentiate based on ingredients, that binding comes in many forms. Understanding their function and the attributes they bring to the final product is crucial in choosing the best binders for your product lines.

For more insight into the binders that will work best with your single-screw extruders, contact your Extru-Tech representative.

## INDUSTRY EVENTS

### **EXTRUSION SEMINAR IN PETFOOD AND AQUACULTURE**

December 7-9, 2016

Ensenada, Baja California, Mexico

### **PETFOOD FORUM 2017**

April 3-5, 2017

Kansas City, Missouri

---

# The **Extru-Technician**

Your drying and extrusion resource

Have the next issue delivered directly to your  
inbox. Just click **here** to subscribe.

(Or visit [http://eforms.kmpsgroup.com/wattpub/forms/extr\\_subscribe.htm](http://eforms.kmpsgroup.com/wattpub/forms/extr_subscribe.htm))





# When it Comes to Food Safety Carefully Choose What Side of the Road to Travel



## What the Competition Offers

- ✓ Low Initial Price
- ✓ Many Promises

## What Extru-Tech Offers

- ✓ Comprehensive regulatory compliance
- ✓ Validated Kill-Step
- ✓ Team of professional experienced food safety personnel
- ✓ Managing the Critical Control Point within pre-set thresholds
- ✓ Equipment solutions engineered around food safety compliance

Contact Extru-Tech today at 785-284-2153 or visit us online at [www.extru-techinc.com](http://www.extru-techinc.com).



P.O. Box 8  
100 Airport Road  
Sabetha, KS 66534, USA  
Phone: 785-284-2153  
Fax: 785-284-3143  
[extru-techinc@extru-techinc.com](mailto:extru-techinc@extru-techinc.com)  
[www.extru-techinc.com](http://www.extru-techinc.com)