

The benefits of insoluble cellulose fibers as an important and versatile functional ingredient in pet food



By Geert van der Velden, Innovation Manager at IQI Trusted Petfood Ingredients

While their benefits were previously often overlooked, dietary fibers are now increasingly recognized as an important functional ingredient in pet food. A healthy diet for pets, such as cats and dogs, contains a mix of both soluble and insoluble, fermentable and non-fermentable dietary fibers. Specifically, insoluble fibers are particularly important for healthy bowel functioning, offer additional advantages such as weight management and feline hairball control, and have excellent technical properties, such as good water holding capacity. Of the available fiber sources, purified cellulose powder offers the highest concentration of insoluble fibers.

Soluble vs insoluble fibers

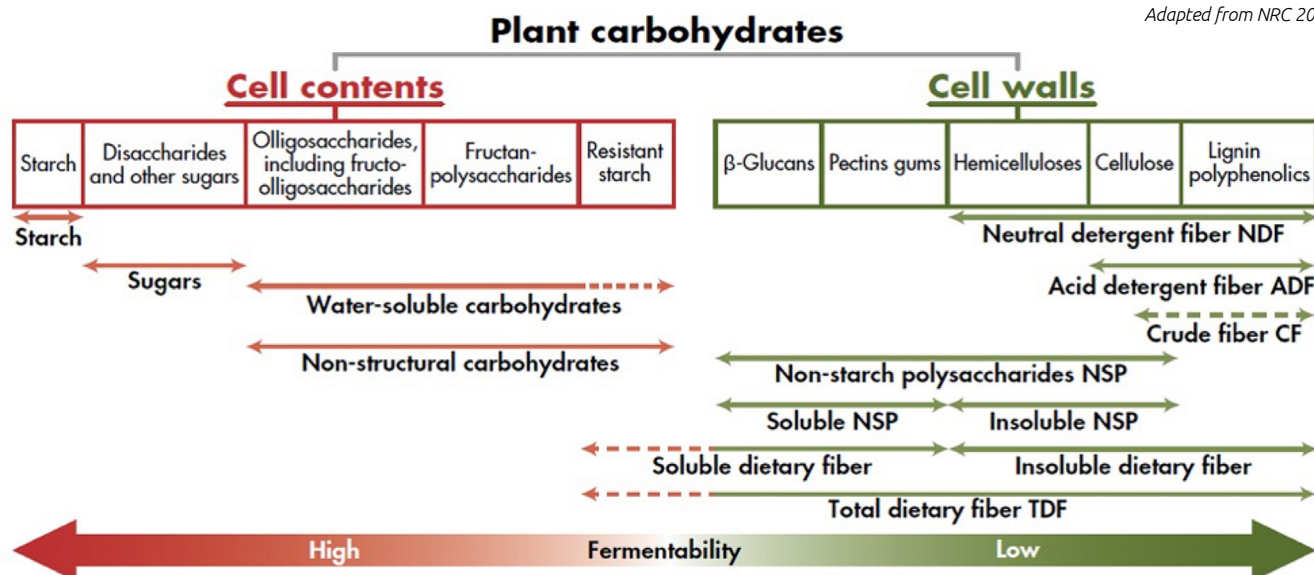
Dietary fibers are an important part of any healthy diet for both humans and pets, such as cats and dogs. There are many different kinds of fiber, but the main distinctions in functionality are between soluble versus insoluble fibers and fermentable versus non-fermentable fibers. Different kinds of fiber offer specific health benefits, such as good gut health.

Soluble fiber dissolves in water and gastrointestinal fluids, when it enters the stomach and intestines, and is fermented in the large intestine. Insoluble fiber does not dissolve in water or gastrointestinal fluids and passes through the intestinal digestive tract fully or mostly intact. Depending on the type of fiber, insoluble fibers may partially ferment into short-chain

fatty acids that stimulate the 'good' microflora in the gastrointestinal tract, thereby acting like a prebiotic.

These different kinds of fiber are plant carbohydrates found in natural food sources, such as vegetables, fruit, whole grains and legumes (see figure 1).

Soluble and insoluble, fermentable or non-fermentable fibers are equally important to cats and dogs but have specific functionality contributing to good gut health and a lower risk of different kinds of disease, including obesity, inflammatory bowel disease, cardiovascular disease, diabetes and metabolic syndrome. Of the different kinds of fiber, insoluble, non-fermentable fibers are particularly important for healthy bowel functioning and have various other specific benefits.



Fiber describes a myriad of different and distinct components.

Figure 1: Different properties of various plant carbohydrates.

Fiber sources

Dietary fibers are the structure-building components of plants, a type of complex carbohydrate that cannot be broken down into digestible sugar molecules by the enzyme system of the pet's body.

Insoluble dietary fibers for use in pet food are available from different sources, such as wheat bran, corn fiber, beet pulp or soybean hulls. Yet, by far the highest amount of insoluble fibers can be found in purified cellulose powder (see table 1).

Cellulose is the most abundantly available organic or complex carbohydrate polymer and is found in all plant cell walls. Cellulose is an important structural component of plant cell walls, in which cellulose is bound together by polyphenolic polymers called lignins. Purified cellulose can be separated from the

lignins and hemicellulose through a so-called sulfate process. Cellulose can be obtained from all kinds of lignocellulose, or plant dry matter.

Health benefits

While insoluble dietary fibers have no intrinsic nutritional value, they offer specific advantages for good gut health in cats and dogs. The inclusion of insoluble fibers in pet food stimulates bowel functioning and aids digestion and regularity. As an indigestible material, insoluble fibers absorb fluid and stick to other by-products of digestion in the gastrointestinal tract. This stimulates intestinal tract movement and the processing of waste.

Due to their excellent water holding capacity,

insoluble fibers help to regulate the consistency and water content of stools. Cellulose fibers act like a sponge, meaning that water can be taken in but also released again under pressure, thereby either retaining fluid to soften the stool or absorbing water to add form to the stool. This helps to prevent both constipation and diarrhea, results in better stool quality and helps to prevent anal gland problems.

Feeding-relevant fibre fractions (%) in various fibre-rich feedstuffs

Feedstuff	Crude Fibre	NDF	ADF
Wheat bran	12	40	12
Beet pulp	14	41	21
Soybean hulls	35	56	40
Apple pomace	21	58	47
Lignocellulose	65	85	70
Powdercellulose	75	90	80

Source: **ICCF**
www.iccf.de

Table 1: Fractions (%) of crude fiber, neutral detergent fiber (NDF) and acid detergent fiber (ADF) in various fiber-rich feedstuffs.

Cellulose fibers are also a good means of weight management. Cellulose fibers add bulk to pet food but contain no calories and ensure a longer period of satiation. This is especially beneficial to pets suffering from obesity and older pets. Another advantage of including cellulose fibers in pet food is the scouring effect that helps to keep teeth clean.

Feline hairball control

An additional unique and successful application of insoluble cellulose fibers is feline hairball control. The cellulose fiber network prevents the agglomeration of single hair strands in the stomach. Fibers have the ability to bind loose hairs in the stomach, causing them to pass along into the duodenum and through the digestion system until the hairs and fibers are finally excreted with the feces. This decreases the need for cats to eject hairs from the stomach by vomiting them as hairballs. Published research indicates efficacy with at least 4% of purified cellulose fibers of approximately 120 - 200 μm in length.

Improving pet food physical properties

Cellulose fibers have applications in both dry and wet pet food, as well as in semi-moist snacks and treats. They can be applied in pet food either as lignocellulose, in the form of wood fibers with a certain length and functionality, or as purified powdered cellulose from which the lignins and hemicellulose have been removed. The choice of

lignocellulose or powdered cellulose depends on the application and region, since only powdered cellulose is allowed for pet food applications in the US while both are allowed in Europe. In certain cases, such as pet food for larger canines, lignocellulose can be a more cost-effective alternative.



Figure 2: Powdered white cellulose obtained from organic material.

In general, powdered cellulose is preferred because of its more neutral taste and odor, resulting in a high degree of acceptance by cats and dogs. Cellulose fibers are used to improve the texture of pet food products, giving them a meat-like texture. Cellulose fibers are insoluble in oil and water but have excellent oil- and water holding capacity. Cellulose fibers are also chemically inert, temperature-stable and pH-resistant.

The degree of coarseness of powdered cellulose determines the length of the fibers and thereby its functionality. Very long fibers have the best technical

The production of (ligno)cellulose

Lignocellulose for applications in pet food is solely produced through the mechanical processing of untreated wood vegetable scaffold substances. The pieces of wood are cut to length, stripped of bark and then shredded, dried and milled with high-end equipment to ensure a particular length of the fibers. Wood has a cellulose content of 40 to 50%. Using different kinds of tree, wood chips can also be used for the production of powdered cellulose using a so-called sulfate process.

The wood chips are conveyed into a continuous digester, in which they are chemically disintegrated through a combination of pressure, high temperature and the addition of caustic soda and

sodium sulfide. This causes the lignin to disintegrate and release the cellulose fibers that hold the wood fibers together. The cellulose fibers are then conveyed to a succession of cleaning and washing stations, followed by a chlorine free (ECF) bleaching process. The bleached pulp is then dried and ground into purified cellulose powder. The sulfate process is a largely closed circuit, which includes the recovery of all of the digestion chemicals. The remaining biomass is combusted for energy.

Only the so-called white cellulose (see figure 2) directly obtained from organic material is used for food, feed and pet food applications. So-called gray cellulose, produced from recycled and de-inked paper and cardboard, is solely used for technical applications.

properties, such as very good water- and oil holding capacity or anti-hairball effects. Long cellulose fibers have lower bulk density and a more fibrous character, making them most suitable for the production of chunks. Shorter fibers are more suitable for extruded pet food applications and improve texture and strength. Medium and long cellulose fibers are also highly suitable for baked products, such as treats and snacks, and provide added strength while reducing the chance of breaking.

Cellulose fiber solution from IQI Trusted Petfood Ingredients

Together with its partner CFF, IQI Trusted Petfood

Ingredients is a supplier of premium lignocellulose, purified powdered cellulose and customized fiber blends to the pet food industry. Our source of wood for the production of powdered cellulose is obtained from FSC (Forest Stewardship Council) certified trees. IQI Trusted Petfood Ingredients' lignocellulose and powdered cellulose has a typical inclusion level of 0.5% to 15% depending on the application target and recipe.

For more information on premium lignocellulose or purified powdered cellulose and the finest ingredients for the pet food industry, please visit our [website](#) or contact us directly.

Want to know more?

[CFF partner of IQI as supplier of \(ligno\)cellulose](#)

[Alternative Dietary Fiber Sources in Companion Animal Nutrition](#)

[Beynen AC, 2018. Anti-hairball cat food](#)

About IQI Trusted Petfood Ingredients

IQI Trusted Petfood Ingredients is a global distributor of premium-claim ingredients to the top brands in the pet food industry. Founded in 1994 as a trading company in raw pet food materials, today IQI offers an extensive variety of services to aid and assist our customers and suppliers worldwide. IQI Trusted Petfood Ingredients employs highly skilled personnel, owns and operates a global network of logistical hubs, and relies on a global supply network to obtain the purest natural resources available.

For IQI, quality is key. IQI Trusted Petfood Ingredients goes to great lengths to ensure the quality of its products and also invests a great deal in maximizing the quality of its partnerships. Since this business is all about trust, IQI needs to bond with its partners to succeed. By working closely with both its customers and suppliers, IQI creates full transparency in the supply chain. IQI oversees and controls every step in

the process from source to shelf and supplies products that are pure and traceable to their source.

About Geert van der Velden

Geert van der Velden is IQI Trusted Petfood Ingredients' Innovation Manager responsible for Business Development, generating new products and concepts that meet the needs of existing and new customers. Geert has more than 25 years' experience in the international pet food industry and has gained knowledge and experience in many sections of IQI's business.

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