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Natural dietary fibers as an important and versatile functional ingredient in pet food

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

Dietary fibers are increasingly recognized as an important functional ingredient, rather than merely as a means to add bulk to pet food. Fibers come in many shapes and sizes, and from many different plant-based sources and ingredients, but the main distinctions in functionality are between soluble versus insoluble fibers and fermentable versus non-fermentable fibers. These different kinds of dietary fiber are equally important to cats and dogs but have specific functionality and unique benefits that should be taken into account, such as health benefits, total fiber content and composition, palatability, and technical properties.

Dietary fibers are plant carbohydrates found in natural food sources, such as vegetables, fruit, whole grains, legumes, and seaweed. At first glance, they seem an unlikely dietary requirement for cats and dogs. Cats in particular are true carnivores with a short and simple digestive tract. They have a low ratio between body length and intestine length of 1:3. For dogs this is 1:4, while a true omnivore, like a pig, has a ratio of 1:14. This means that especially cats, and to a lesser extent dogs, have moderate colon fermentation capacity and require highly digestible food. Domesticated cats and dogs live under different conditions with different nutrition than they would find in nature, however, which often does not include prey, and they therefore benefit from fibers in their diet.

The inclusion of a mix of soluble and insoluble, fermentable and non-fermentable dietary fibers offers a number of advantages for cats and dogs. Their specific functionality contributes to good gut health and a lower risk of different kinds of disease, including obesity, inflammatory bowel disease, cardiovascular disease, diabetes, and metabolic syndrome. Realizing these health benefits depends on the kinds of fiber, their physical structure, the total fiber content, and fiber composition from different kinds of ingredient.

SOLUBLE FIBERS FOR A PREBIOTIC EFFECT

Soluble fibers dissolve in water and gastrointestinal fluids when they enter the stomach and intestines, and are fermented in the large intestine to become a substrate for the 'good' microflora in the gut. These beneficial microflora ferment the fibers into volatile short-chain fatty acids, resulting in an increase in their population in the gastrointestinal tract. This process is described as a prebiotic effect and has specific benefits for the health and well-being of cats and dogs.

Prebiotics, in general, contribute to diverse and balanced gut microbiota, which reinforce the natural defensive response to pathogenic and toxigenic bacteria. Thus prebiotics offer an effective reinforcement against digestive disorders, such as diarrhoea and inflammatory bowel disease. They help the animal to digest food more efficiently. Prebiotics acts as food for probiotics, which can also be added to pet food directly. After the body has digested these, postbiotics are formed, which include nutrients, antimicrobial peptides that slow down the growth of harmful bacteria, and volatile short-chain fatty acids that aid healthy bacteria to flourish. Soluble dietary fibers for

use in pet food are available from different plant-based sources, such as carrot, oats, peas, beans, apples, beet, and seaweed. Prebiotics can also be found in certain specific ingredients, such as Miscanthus grass, which contains Xylooligosaccharides (XOS) prebiotics. An exception among plant-based sources of prebiotics are Galacto-oligosaccharides (GOS), which are non-digestible, soluble fibers manufactured from lactose (milk sugar) in cow's milk, and are also known as second-generation prebiotics. A specific benefit of GOS is that they help to reduce fecal odor.



INSOLUBLE FIBERS TO STIMULATE BOWEL FUNCTIONING

As opposed to soluble fibers, insoluble fibers do not dissolve in water or gastrointestinal fluids and pass through the intestinal digestive tract fully or mostly intact. As an indigestible material, insoluble, non-fermentable fibers have no intrinsic nutritional value. They contribute to good gut health, however, by stimulating bowel functioning and aiding digestion and regularity. Insoluble fibers stick to other by-products of digestion in the gastrointestinal tract, thereby stimulating intestinal tract movement and the processing of waste.

Due to their excellent water-retention capacity, insoluble fibers help to regulate the consistency and water content of stools. Acting like a sponge, they can either retain fluid to soften the stool or absorb 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. Insoluble fibers can also be used for weight management by adding bulk to pet food. Depending on the specific length of fiber, insoluble fibers can have additional benefits, including helping to keep teeth clean and feline hairball control. Fibers of the right length have the ability to bind loose hairs in the stomach, causing them to pass along into the duodenum and through the digestive 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.

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. By far the highest amount of insoluble fibers can be found in purified cellulose powder, wood fibers from which the lignins and hemicellulose have been removed through a so-called sulfate process. Due to the chemical process used to produce purified cellulose powder, however, it is not always considered a fully natural product. Insoluble dietary fibers for use in pet food are also available from a range of different natural sources, such as miscanthus grass, wheat bran, corn fiber, beet pulp, soybean hulls, carrot, or seaweed.

THE UNIQUE PREBIOTIC EFFECT OF SEAWEED

Of the different pet food ingredients rich in fibers, seaweeds are an excellent source of soluble and insoluble, fermentable and non-fermentable dietary fibers. In particular, different kinds of seaweed are some of the most concentrated sources of soluble fibers, with levels as high as 40%. The fibers found in red, brown, and green seaweeds are therefore prebiotics. Unlike land-based plants, different seaweeds contain many unique compositions of complex carbohydrate or polysaccharide fibers that are used as the preferred source by the different species of bacteria. Also, as opposed to land-based prebiotic fibers, seaweeds have negligible lignin, meaning that fibers found in seaweeds ferment far more readily, thereby enhancing the prebiotic effect in the gut.

Particularly green seaweeds offer a cost-effective ingredient with high palatability, low level of contaminants, and an excellent reputation as a healthy source of food for both humans and pets. Blends of seaweed of all three colors can also be formulated based on the seaweeds' bioactive properties to achieve broader efficacy, targeting specific performance and bioactivity.



MISCANTHUS OR ELEPHANT GRASS

Miscanthus fiber is an all-natural, sustainable, and functional ingredient that is particularly rich in insoluble fibers and can be used as a fully natural alternative to cellulose. Miscanthus flour is made from 100% Miscanthus grass, also known as Elephant Grass. Miscanthus is a non-GMO perennial crop, which is harvested and lightly manufactured into the final product using no chemicals or other added ingredients. Miscanthus contains around 79% insoluble fibers, 1% soluble fibers and 13.5% Xylooligosaccharides (XOS). XOS are polymers of the sugar xylose that act as a prebiotic. Similar to cellulose, Miscanthus fiber has additional benefits, including feline hairball control, dental health, weight management, and fecal consistency. For optimal gut health results, a combination of Miscanthus fiber and tomato pomace can be recommended, which provides an excellent blend of insoluble and soluble fibers.

FIBERS FROM FRUIT AND/OR VEGETABLE SIDE STREAMS

Different kinds of pomace, a fruit or vegetable pulp formed by mashing side streams of human food manufacturing processes, provide an excellent source of dietary fibers. Tomato pomace consists of skins and seeds that are by-products of the production of tomato paste and peeled/chopped tomatoes. It contains around 36% dietary fibers, of which the majority are insoluble fibers, and is also an important source of Lycopene, a carotenoid found in tomatoes that has strong colorant and antioxidant properties. Apple pomace, the pulp residue from apple juice production, contains around 63% insoluble fibers and is also an excellent source of pectin and vitamins A and C.

FUNCTIONAL CARROT FIBER

Another interesting, fully natural alternative to cellulose is functional carrot fiber, which is a special and very functional type of carrot pomace. Functional carrot fiber is produced as a side stream of the human food production of carrot juice. Peeled and cut carrots are squeezed and the remaining carrot pulp, rich in dietary fibers, is used as an ingredient for pet food. The pulp is dried and milled into powder with no further additives. Unlike some other vegetable fibers, functional carrot fiber is derived exclusively from the edible part of the carrot and are produced using a unique, natural production process.

Functional carrot fiber has a total fiber content of around 60%, of which some 33% is insoluble and 27% is soluble fiber. Besides dietary fibers, it also contains 5% crude protein, 21% carbohydrates, and is rich in carotene, vitamin K1, potassium, and antioxidants. Functional carrot fiber has a very high water-retention capacity for a natural fiber of around 1 to 26. The fibers are cold and hot swelling, and therefore do not require any technological intervention. They create texture and have applications in both wet pet food and slurry that is fed to an extruder.



UTILIZING SIDE STREAMS OF PEAS AND RICE PRODUCTION

An advantage of using side streams of natural products is that it adds both soluble and insoluble fibers together with other nutrients, such as proteins, carbohydrates, and minerals, to the diet. Pea hull fiber, another example of a side stream, is an important source of insoluble fiber for use in pet food formulations. Yellow peas contain two sources of dietary fiber, namely the outer fiber of the seed coat and the inner fiber of the peas. The seed coat is known as pea hull fiber (PHF), which contains approximately 84% dietary fiber of which the majority (approximately 71-76%) is insoluble fiber, primarily cellulose. PHF has a low degree of fermentation, good bulking properties due to its important water-retention and oil-binding capacity, and is recommended for hairball control in cats. Pea fiber has a neutral taste and does not affect palatability. It can be used in both wet and dry pet food applications.

Rice bran is another side stream, this time from the rice milling industry, which contains 21% dietary fiber, of which the majority is insoluble fiber, as well as 14.5% protein and 28% carbohydrates. Rice bran also contains a fat percentage of 18.3%, however, and needs to be stabilized to prevent oxidation.

SPECIFIC BENEFITS OF OAT BETA-GLUCAN

Another specific beneficial ingredient is oat beta-glucan, a soluble oat bran fiber extracted from wholegrain oats without the use of chemicals. The dietary fibers can be used as a dietary supplement for dogs, offering important health and functional benefits. Research has shown that oat beta-glucan helps to reduce blood cholesterol levels and maintain blood cholesterol concentrations that are within the normal range, thereby reducing the risk of dogs developing coronary heart disease. Likewise, research has indicated that oat beta-glucan as a dietary supplement helps to maintain healthy levels of blood glucose.

Table 1: Different fiber sources

Fiber source	Total dietary fiber	Soluble dietary fiber	Insoluble dietary fiber	Remarks
Seaweed green	38%	21%	17%	Holistic prebiotic source
Cellulose	99,5%	0,5%	99%	Purified, insoluble fiber source
Miscanthus grass	80%	1%	79%	Sustainable cellulose alternative
Beet pulp	69%	20%	49%	
Tomato pomace	57%	4%	53%	Great source of natural AO lycopene
Apple pomace	64%	9%	55%	
Psyllium husk	90%	80%	10%	
Functional carrot fiber	60%	27%	33%	1:26 water binding capacity
Pea hull fiber (PHF)	82%	26%	56%	
Rice bran	23%	2%	21%	
GOS	n/a	50%	0%	On 70% solids
Oat beta-glucan (fiber)	40%	34%	6%	34% functional 1,4 beta glucan

NATURAL DIETARY FIBER SOLUTIONS FROM IQI TRUSTED PETFOOD INGREDIENTS

Together with its different suppliers, IQI delivers a range of ingredients that are rich in natural dietary fibers for pet food applications. These include seaweed, Miscanthus or Elephant Grass, functional carrot fiber, pea hull fiber, rice bran, and oat fiber.

For more information on these different ingredients rich in fibers and the finest ingredients for the pet food industry, please visit our [website](#) or contact us directly.

Want to know more?

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

[IQI white paper 'GOS prebiotic pet food ingredient stimulates a healthy gut'](#)

[IQI white paper 'Seaweeds as a rich source of prebiotic dietary fibers and important nutrients for pet food'](#)

[IQI white paper 'The benefits of insoluble cellulose fibers as an ingredient in pet food'](#)

ABOUT IQI TRUSTED PETFOOD INGREDIENTS

IQI Trusted Petfood Ingredients is a global provider 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 develop innovative new products. IQI 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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