

## Upcycled Barley: The Protein Brewery Part 2

This second installment on upcycled barley continues from the previous April/May issue on barley protein application opportunities. Contributed by Henk Hoogenkamp.

### Meat: Intertwined Protein and Fibre

Barley protein and fibre “flour” are not just nature-friendly but also helpful in increasing water-holding capacity in emulsified meat products that leads to higher processing yields, improving texture, reducing purge, and enhancing sensory properties. For example, EverVita’s ingredient solution has a slight sweet honey-like taste profile. Taste and colour will remain optimal during the shelf life of the consumer product. Depending on the country, the ingredient can be listed as ‘barley protein & fibre’, ‘barley flour’, or ‘barley protein extract’.

Evervita’s upcycled barley protein is an omni-performance plant-based solution offering exceptional fat-water binding, as well as premium sensory and taste experiences. Its processing does not generate any wastewater nor uses chemicals or additives. These types of dry-fragmented ingredients are the future of sustainably sourced upcycled plant proteins that have a low carbon footprint. Because of its close association with traditional beer brewing, upcycled spent barley protein has important mainstream consumer awareness.

EverVita (38% protein) is an innovative dry-fragmented protein that excels as a binder in both emulsified and coarse ground-processed (plant) meat products, as well as in various extruded shapes and sizes. This protein-containing ingredient (38%) has a “flour-like” nature and its fibre (36%) is insoluble, making it especially suitable for processed meat as well as for hybrid processed and plant meat products. This natural barley protein is a meaningful alternative protein source for (plant) meat products as both ‘binder glue’ and/or structuring protein for extrusion systems. In emulsified and coarsely ground meat products and plant-meat foods, the water-holding capacity of EverVita is 1:3.5.

EverVita is a safeguard for water and fat holding, texturing properties in complex finely and/or coarsely ground (plant) meat products. The unique combination of protein and water insoluble fibre delivers cost-efficient solutions.

One of the main advantages of barley-spent grain is that most of the starch component is already removed during the beer brewing process. This will greatly improve the dual economics of scale. A possible





EverVita barley fibres and proteins produces ingredients solutions that aim to enhance the gut health benefits of baked goods, pasta, pizza crusts, snacks, and other food products naturally, without altering their taste, texture, or composition. Formulated to be mild in taste and having a clean label, it boasts of the ability to add significant nutritional value to food products while making sustainability more delicious than ever before.



drawback is that barley-spent grain has its protein and fibre component structurally and chemically intertwined tightly. This will somehow reduce the protein recovery yield. But, even at reduced protein recovery ability, barley-spent grain has significant cost advantages compared to soy and pea protein.

### Plant Bakery

When it relates to bakery and patisserie products, consumers rank grains and seeds as the number one contributor to health and organoleptic superiority. The evolving plant protein and fibre trend present challenges and opportunities for the bakery industry. Even though health and wellness in bakery and premix formulations are patisserie megatrends that are driving new product development, consumers still prefer indulgent treats with an impressive flavour profile and texture as well as a clean and natural label at the same time. These are lofty goals, yet can pose formulation challenges because every new food trend creates new problems to solve.

Consuming foods that are better for health and ecologically sustainable for the planet are often linked

with alternative protein sources. These “grain or pulse solutions” are shifting away from the traditional and often unsustainable animal-based protein ingredients.

Depending on the region, EverVita can be labeled as “barley flour” which is a meaningful option for bakery and patisseries products in need of a protein and fibre-rich bulking ingredient that maintains a soft and moisture appearance. This dry-fragmented low-starch barley ingredient has double-boosting performance properties providing essential proteins combined with the gastrointestinal benefits of insoluble dietary fibres for prebiotic health. However, to be balanced and fair, the inclusion level of EverVita in processed foods is limited due to the presence of water-insoluble fibre, which has the tendency to dry out textural properties.

### Barley Fibre

Not all fibres are the same in offering a variety of foods or fibre supplements to the gut bacteria that helps maintain a higher diversity, which supports improved resilience of the gut microbiome toward external challenges like stress and prolonged bad dietary habits.

The barley grain is a protein and fibre-rich food. Its fibre provides many benefits for gut and immune health. As a matter of fact, most of the body's immune system is linked to the gut, thus barley fibre will appeal to health-conscious consumers. The native barley grain has a good balance of soluble and insoluble fibres and with beta-Glucans especially of interest because of their association with lowering cholesterol. In addition, there is a very low sugar, salt content, while displaying important minerals like calcium, magnesium, iron, and zinc.

Due to the performance properties of barley fibre, a wide range of functional benefits of this all-natural "clean label" ingredient can be used to improve emulsion stability, mouthfeel, and texture of formulated foods like (plant) meat and bakery products.

Upcycled barley fibre is a light-brownish coloured ingredient that offers high water binding capacity, combined with excellent swelling properties at cold and warm temperatures. For these reasons, the barley fibre can ideally be combined with cereals, baked goods, and (plant)meat products at inclusion levels of 1 to 2- percent.

At these low inclusion levels, the insoluble barley fibre is a cost-effective solution that contributes to multiple benefits. When mixed with water, the barley fibre soaks up about 6 times its weight in water and the resulting surface expansion allows additional oil to be immobilised. Both purge and oil separation will be positively controlled.

This functional ingredient can also be (partially) used to replace starches, methylcellulose, and hydrocolloids that are typically needed at much higher inclusion levels. Moreover, barley fibres are excellent flavour carriers that remain dry until water is added. Lastly, the barley fibre supports correcting the greyish off-colours shades and improves flavour profiles that are usually associated with many plant protein ingredients.

Lack of dietary fibre is a serious issue that spreads wide across many countries. Awareness of the role of fibre in improving gut health is scientifically well established, including the link between fibre intake in relation with gut health and immunity.

Upcycled barley fibre is an ideal vehicle for dietary supplementation and is well-tolerated at up to 10g per day into a slower fermentation in the intestine, leading



Consumers want to have the best of everything: Indulgent treats that do not compromise on flavour, texture, nutrition, clean labelling and sustainability.



to less gastric distress than other fibres of quicker gut fermentation. The prebiotic effect has a positive impact on the microbiome through the promotion of specific gut strains.

### Hybrid Cornerstone

When everything is said and done, the cornerstone of business for most plant protein ingredients is still usage in processed (hybrid) meat products and plant meat foods. Basically, the plant protein ingredients are either used as a dry powder to build emulsion structure and/or in extruded form as an alternative to simulate the structure of ground lean meat.

It is important to distinguish two entirely different market segments for these plant protein ingredients: in many countries, textured plant protein ingredients are used to aggressively reduce food costs by replacing expensive lean meat. For example, the Burger McDo is the best-selling hamburger at McDonald's Philippines showing a plant protein inclusion level well over 50 percent. These types of products are typically described as "hybrid" i.e., a blend of lean meat and hydrated textured plant protein.

For affluent consumers, plant meat products are not primarily driven by food costs, but rather answering to increasing consumer categories for vegetarian or vegan lifestyle choices, including dietary, ethical, animal welfare, and sustainability concerns.

A hidden feature of barley protein is the presence of natural browning components that allow reduction or elimination of expensive malt or caramel additives. Plant meat products such as burgers are mostly formulated using soy- or pea protein. Both soy- and pea proteins, however, need additional additives to bring out the true colour of cooked meat. Barley protein extract, together with red beet juice, is an all-natural solution to imitate the appearance of hemoglobin to improve the desired optics in various shades of brown.

Advantages of barley protein extract for hybrid meat and plant-meat applications:

- Natural brown colour
- Eliminating malt or caramel colours
- Improving the grey tone of soy protein
- Light-sweet flavour
- Clean label 'barley extract'
- Heat and frying stable
- Dry addition to mixing/blending process

### Barley Texturising Solutions

EverVita is a "clean label" and non-GMO vegan barley protein offering functionality that are made through a mechanical process via upcycling what was once seen as a by-product of the beer-brewing industry. EverVita can improve viscosity and enhance moisture retention and freshness prolongation in a wide range of foods, while boosting structure and texture in plant-based meat alternatives.

The EverGrain company mission is to expand the plant ingredient portfolio with a range of high-quality barley protein products. EverVita barley protein ingredients are insoluble "beer native" proteins that have been made using dry fragmentation showing a protein content of 38 percent. These ingredients are available in both powder and extruded form to build structure, mimicking meat texture and moisture release. Extruded products have a wide range of ingredient options, including combinations of barley protein and wheat gluten providing low-cost options for a wide range of plant meat and hybrid meat products.

### On the Horizon: Precision Fermentation

Spent barley can transition into human nutrition by using either conventional protein separation technologies or precision fermentation, a biotech revolution that will fundamentally transform the food protein landscape in the years to come. For example, spent-barley grain can possibly serve as a culturing vehicle to grow 'vegan casein', a milk protein derivative, in animal-free alternatives using systems such as precision fermentation and facilitated expression of modifying genes.

Precision fermentation-derived proteins use microbes such as fungi, yeasts, algae, or bacteria to replicate existing proteins e.g., whey protein isolate and egg albumen. Precision fermentation is an example of how genome-editing technology can be successfully used with the help of optimised microorganisms to generate protein ingredients that are nature-identical but can produce more sustainable than traditional animal protein. As such, synthetic biology will play a major role in the food disruption across the entire value chain that will ultimately provide consumers great-tasting, as well as nutritionally and environmentally sustainable products. As protein know-how moves ahead, it is expected that emerging technologies like gene editing and artificial intelligence (AI) and Machine Learning (ML) Algorithms will speed up organoleptic and performance improvements, such as water binding, fat binding, colour, flavour, and taste sensations.



Now that plant nutrition is trending, it can be expected that the go-to-market time for barley protein will be on a shorter trajectory.

To sustainably and efficiently feed the global population, genetic manipulation technologies will become an essential contributor to the food supply chain. Bio-engineered ingredients do not have credible scientific evidence that these crops or processing technologies have any adverse health effect.

Synthetic biology will fundamentally change the world. Anaerobically fermented protein is the next pillar in the alternative protein movement, converting plant starches into complete microbial protein ingredients. These fermented proteins provide ingredients that are naturally high in essential amino acids and branched chain amino acids, vitamins, and minerals, while also contributing to postbiotic benefits for gut health. These compelling nutritive benefits are sustainably produced at cost-efficient price points.

Precision fermentation is embracing the very latest biotechnological science, and such methods will become the driver of food security in the years to come. However, precision fermentation of biomass (waste) material is not going to economically compete with the current chemical and dry-fractioning protein concentrating or isolating systems anytime soon.

### Fine Tuning by Design

The use of enzymes such as protease, amylase, and bromelain is also termed hydrolysis, which is the process of cutting or splitting the protein chain into pre-determined chain lengths. As a rule of thumb, the higher the enzyme dosage and the longer the incubation or holding time at preset temperatures, the higher the protein or amino acids content. Yet, a possible negative side effect of longer incubation is that amino acids and peptides are formed with a bitter note. Seemingly, small processing changes can

have significant influence in the protein performance such as its dispersibility and solubility, as well as its foaming, gelling, and emulsification properties.

The arrival of designer enzymes now allows targeting and modifying the specific functionalities of plant protein ingredients. Most of these performance and properties are:

- Reduced bitterness
- Create umami flavour
- Create bioactive peptides
- pH acidity stability
- digestibility
- dispersibility
- solubility
- reduced allergenicity
- gelation
- emulsification
- salt tolerant
- temperature stability
- non-dusting
- non-lumping
- low-glycemic
- light colour versions

### The Slow Road to Success

The road to introduce a new protein ingredient is quite long. From early introduction to first order can take a minimum of 12 months, although a two-to-three-year evaluation, testing and validation wait is more realistic. The most likely introduction scenario is to offer food companies alternative protein solutions that clearly give application and nutrition performance, as well as cost benefits.

Although new introductions of plant protein ingredients take time before the protein is used in formulated foods and beverages, plant nutrition has a great tailwind that helps the speed to market introduction. Now that plant nutrition is trending, it can be expected that the go-to-market time for barley protein will be on a shorter trajectory. Apparently, the introduction of a new plant protein ingredient still requires flawless marketing framing strategy in all areas of execution: application, health capabilities, as well as pro-active and solution-driven product availability through distribution channels and competitive value propositions. **APFI**



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