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What's New in the World of Proteins?

Novel and Blended Proteins

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A Leatherhead Food Research white paper

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What's New in the World of Proteins?

With consumers waking up to the nutritional benefits of proteins, they are now the buzzword on every product developer's lips. In this white paper, Dr Pretima Titoria explores how the market is moving to plant-based proteins, talks about the future for insect proteins and discusses the opportunities for blending proteins.

With the global population expected to reach over 9 billion by 2050, the demand for protein is set to rise. Valued at $24.5 billion in 2015[1], the global market value of the protein ingredients' market is forecast to be worth $31 billion by 2018[1].

Currently, 66% of the protein ingredients' market comes from animal sources[1]. Animal protein is expensive to produce and raises numerous sustainability considerations, utilising large amounts of land, feed and water, and producing high levels of greenhouse gas.

The remaining third of the protein ingredients' market comes from plants/vegetables[1]. Conservative estimates suggest plant proteins will take a 40% share of the protein ingredients' market by 2018[1]. Offering to meet the growing protein need in a more sustainable way than traditional animal proteins, these also address a number of key consumer trends, including the consumer desire to eat less meat, the rise in 'free-from' or 'allergen-free' products and the desire for products positioned as 'healthy' and 'natural'.

The plant protein ingredients' market is dominated by soybeans (56% comes from soybeans[1]). Other plant sources, currently available, include wheat and rice. Pea protein is one of the fastest-growing plant-based proteins used in new product launches[2]. Food and drink product launches using pea protein increased 49% between 2013 and 2014[2]. One key benefit of pea protein is that it is a less common food allergen, unlike the more common sources of plant-based proteins, such as wheat and soybean.

Consumers picking protein for health benefits

Protein has long been acknowledged by consumers for increasing muscle mass but it is now gaining recognition for its satiety properties (making you feel full for longer) and its corresponding potential to help weight loss. In a survey by Mintel, of the 13% of UK consumers who stated they consumed more proteins than a year ago, nearly half said that this was to help maintain a healthy weight[3].

Animal proteins often contain high levels of fats, particularly saturated fats, whereas plant

[1] Based on estimates by Frost & Sullivan and Grand View Research
[2] Mintel
[3] Mintel. (2014). Protein Fever. London, p 4-7.

proteins are low in fat and are also high in fibre which adds to the satiety effect of the protein. It has also been suggested that some plant proteins may positively affect cholesterol levels and have an antihypertensive effect, so along with the low saturated fat content, replacing animal protein with plant protein may help reduce the risk of cardiovascular disease.

The A-Z of novel proteins

NPD teams are increasingly looking to novel or new proteins, such as those from rapeseed, fungi, aquatic plants and insect, to see if these hold the answer to their needs. Proteins which match current consumer eating trends, such as ‘allergen-free’ or ‘clean-label’ are likely to be successful and gain traction in the industry.

Aquatic Plants

Microalgae are single-celled organisms containing high levels of protein which are incorporated into products whole, and therefore have the benefit of adding fibre. The algal protein is stable over a range of temperatures and pH and can be added with negligible effects on the viscosity, making it ideal for increasing protein content in beverage applications.

Duckweed or water lentil is another aquatic plant which, like microalgae, is non-allergenic. It uses significantly less water than conventional protein sources during manufacture because most of the water can be recycled. The protein extract is a green powder which can be incorporated into protein shakes and snack products where the colour will not be an issue.

Fungi

Hydrophobins are low molecular mass, surface active proteins secreted by fungi, which can be used to stabilise emulsions and foams. They can act to reduce the surface tension of emulsions and foams by coating the surface quickly and forming an elastic membrane, which enables emulsion stabilisation.

Hydrophobins have benefits over several other foam stabilisation ingredients because they prevent the coarsening of foams, as well as stabilise the total foam volume. Two main areas of research for hydrophobin use are in confectionary and beverages.

Insects

Insects have been occupying a lot of column inches in the media recently. From a sustainability point of view, insects need less food, water and space than livestock. Insects are very efficient at converting feed into protein, being twelve times better at this than cattle. Furthermore, they do not produce as much methane as livestock, and therefore have a smaller environmental impact. From a nutritional point of view, insects are a good source of protein, iron and calcium.

Insects are generally eaten in three main forms – whole, ground to a flour or as the protein isolate. In the developed world, eating the whole insect is still considered a novelty and a taboo which will require further education to change. However, research shows less obvious forms of insect protein are becoming more acceptable; a study by Leatherhead found that 39% of UK consumers were willing to try insects crushed into a protein rich flour for baking. Cricket flour has been launched in products such as a high

protein crisps and several protein/energy bars. Insect protein isolates can be processed to make a tofu-like product to imitate traditional meat or used as an egg or dairy replacement in cookies, ice cream and other products.

In terms of the regulation around the use of insects in food and beverages, in the US and Canada, the onus falls on the manufacturer to ensure the insects used are safe for human consumption.

As far as regulation in the EU is concerned, in October 2015, the European Food Safety Authority (EFSA) concluded that insects fed with approved feed materials pose no greater microbiological hazards than other non-processed sources of protein of animal origin[4]. Actual approval for the use of insects in food and beverage products in the EU is tied up with their novel food status. Insects (whole or ground into flour) are not classed as novel foods, while parts of insects fall under the controls of the novel foods regulation. In October 2015, the European Parliament and the Council reached agreement on new novel foods regulation which will extend the scope to whole insects and introduce a fast-track procedure to approve novel foods; when the regulation comes into effect from January 2018, it is likely to speed up the review of novel products derived from edible insects in Europe. From 2018 therefore, we expect to see an acceleration in insect product innovation.

Rapeseed

Soybeans and rapeseed are the top two oilseed crops globally. The oil is pressed from the seeds leaving behind an oil meal which is high in protein and fibre. While soybeans have been used successfully as a nutritious and sustainable source of protein for many years, rapeseed protein has been limited to livestock and aquaculture feed until recently. Rapeseed protein isolates have the ability to replace many of the functions seen in egg protein. Depending on the isolates used, they can provide emulsification properties in sauces and dressing, for instance in mayonnaise, by replacing the egg yolk or act like an egg white to produce high volume, stable foams. They can also be used to replace a whole egg in applications such as cookies. To date, most of the new product launches use rapeseed protein isolate in the processed fish, meat and egg category.

Blending proteins to improve functionality

Blending proteins can bring about significant differences in the physical functionality of the proteins and the nutritional properties of the final product. This is a growing area of interest, and Leatherhead has conducted research into this area.

Leatherhead blended whey protein isolate (WPI) with hydrolysed whey protein isolate (HWPI) at respective ratios of 100:0 (control), 75:25 and 25:75, whilst maintaining a 12% protein concentration[5].

[4] http://www.efsa.europa.eu/en/press/news/151008a
[5] Titoria P. M. and Groves K. (2007). *Interactions of proteins and hydrolysed proteins for novel or improved functionalities*. Leatherhead Food International Report 904.

Leatherhead found that 12% WPI alone produced a coarse granular, short-textured aggregated gel. The addition of the HWPI at a ratio of 75:25 WPI:HWPI produced a significantly weaker, but very smooth, gelled network with no syneresis (liquid oozing out of products).

Preparation of the 25:75 WPI:HWPI mixture created a coagulated mass with a high level of syneresis. Further experimentation with inclusion of a small amount of emulsifier in the 25:75 WPI:HWPI mixture led to development of a creamy, syneresis-free and homogeneous solution.

Blending proteins in this way could lead to new products with different textures, as well as introducing bioactive peptides which are believed to have a wide range of health benefits.

Putting proteins into production

All these novel proteins have the ability to help address our increasing protein requirements while meeting consumer demands for healthy, allergen-free, sustainable and meat-free products. In addition, blending different proteins can lead to enhanced functionalities and health benefits.

Some of the novel proteins are closer to market than others, but it is clear with the pressures on resources that the future of the protein market will be largely plant-derived. During the development of new and existing products, Leatherhead recommends that food manufacturers consider these protein opportunities, including the options for blending proteins for enhanced functionality, in order to meet the changing nutrition and sustainability trends.

How Leatherhead can help

Leatherhead has expertise in food rheology, microscopy and processing to understand and maximise the protein functionality in a wide range of products. Our Insight and Regulatory teams can also determine consumer acceptability and advise on the legal aspects of protein use.

About the author

Dr Pretima Titoria is the Head of Food Ingredients within the Food Innovation Department at Leatherhead Food Research. She obtained her BSc (Hons) in Food Technology from the University of Reading, and her PhD from the University of Cranfield. Her PhD was focused on rheological properties of thickening and gelling agents for food applications. At Leatherhead, Pretima is responsible for managing confidential client projects, which involve physico-chemical characterisation of ingredients and additives in a wide range of food and beverage applications.

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Leatherhead Food Research provides expertise and support to the global food and drink sector with practical solutions that cover all stages of a product's life cycle from consumer insight, ingredient innovation and sensory testing to food safety consultancy and global regulatory advice. Leatherhead operates a membership programme which represents a who's who of the global food and drinks industry. Supporting all members and clients, large or small, Leatherhead provides consultancy and advice, as well as training, market news, published reports and bespoke projects. Alongside the Member support and project work, our world-renowned experts deliver cutting-edge research in areas that drive long term commercial benefit for the food and drink industry.

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