Un-Pea-lievable

How innovative analytical technologies are helping to drive innovation in the pulse- and pea-based ingredients market.

THE GLOBAL DEMAND for new, innovative food products is growing. Modern consumers are increasingly seeking existing foods that are budget-friendly, healthy, and fulfil their demands for quality and texture. To meet the rapidly changing nature of the sector, food development pipelines must evolve and provide novel food types utilising pulse-based ingredients.

Compared to previous food trends, today's consumers seek more than a quickly produced product that meets their need for guilty pleasures. The industry must learn from the shortfalls of previous trends such as the former gluten-free food movement. During this period, many of the first gluten-free products to market exhibited poor mouthfeel and flavour, leading to reduced consumer confidence in such novel food items.

The look, the texture, the taste

In the competitive food market, new products need to meet consumers' performance expectations for appearance, texture and taste. However, the process of designing and developing products with novel and unusual ingredients is an increasingly complex task. Alternative ingredients in these new product formulations go through many storing, cooking and packaging processes, which can affect their performance. As such, processors within the food market are harnessing emerging technologies and applying existing solutions in new ways to design products that appeal to consumer trends.

Most of us will be familiar with Beyond Burger. This pea-based meatless burger has made global headlines in an array of publications and is arguably driving the meat-free revolution.[1,2] Innovative meat analogues, such as the Beyond Burger, are developed with pea protein isolate. As such, processors are increasingly focused on manipulating pea isolate to mimic the look, taste, and texture of meat. In particular, producers are examining how to replicate the 'bite' usually provided by animal proteins.

Across the industry, rheological technologies, such as PerkinElmer's Rapid Visco Analyser (RVA) offerings, are quickly becoming a powerful tool for plant protein food development, due to their ability to provide insights into the functional and sensory properties of meat alternatives.

As the race-to-the-market in the world of plant-based protein becomes progressively more competitive, processors increasingly need access to viscosity measurements to ensure high-quality products. Additionally, expert support in product development is vital to fully exploit these insights.

Tackling pea starch testing

The clean label movement is one of the major drivers influencing the growth of peas. As consumers begin to scrutinize labels, companies are focusing on how to transition towards foods that are free of 'chemical-sounding' ingredients or additives. This invites a new set of challenges – and opportunities – for food ingredient companies.

To better understand the clean label evolution and its impact on the industry, it is best to examine the emerging approaches to test or analyse starch ingredients in food products.

Starch is a versatile ingredient used to impart viscosity, stability and texture to foods ranging from ice creams to powdered, instant products.[3] Compared to traditional starches, pea starch offers numerous functional features that can benefit food production, such as the formation of high-viscosity pastes and stronger gels. This is primarily due to the high amylose content of pea starch. Smooth and wrinkled pea starches contain around 35 to 75 percent amylose,[4] considerably higher than those of traditional starch sources, such as corn, potato and rice. This is particularly useful in pasta production, as higher amylose content provides increased resistance to overcooking and adds a chewy and firm functionality.

Although not commercially available, wrinkled pea starch and flour are of interest to food researchers. Like all starches containing more than 50 percent amylose, wrinkled pea starch displays negligible viscosity in the cooking and cooling process under ambient conditions due to the high conclusion gelatinisation temperatures. Most foods are subjected to variations in their temperature during production, transport, storage, preparation, and consumption. These temperature changes can cause alterations in the physical and chemical properties of food components which influence the overall properties of the final product.

As such, a better understanding of the influence of temperature, especially high temperatures, on the properties of pea-based ingredients enables food manufacturers to optimise processing conditions and improve product quality. It is therefore important to equip food researchers with the appropriate analytical tools to monitor the changes that occur in foods when their temperature varies.

Utilising analytical technologies provides food designers with a method to monitor viscosity of ingredients during heating and cooling cycles. Instruments like the RVA describe the viscosity parameter as functions of temperature and time. In particular, the RVA describes paste behaviour in three periods: (i) a controlled heating period, increasing the temperature of the suspension from room temperature to a maximum that is generally determined at 95°C; (ii) an isothermal period, maintaining the suspension at the maximum temperature for analysis; and (iii) a cooling period, decreasing the temperature to approximately 50°C. The changes in the viscosity of starch suspension due to temperature and time are used to construct a pasting profile of the starch, providing detailed insights into an ingredient's behaviour and applicability.

Beyond viscosity analysis to DSC for pea-based starches

In the food industry, many food products experience extreme processing conditions of high temperature and high shear stresses. When starch is used as a hydrocolloid in canned, extruded and dairy food products, the processing temperatures commonly reach beyond 95°C. Traditional viscometer solutions typically operate at a temperature of up to 95°C, thus are unable to cover the whole application spectrum of pea-based ingredients in food systems. Analysing the characteristics of an ingredient at temperatures above 100°C has generally been limited to calorimetry techniques. Calorimetry, however, does not analyse the series of changes that occur during cooking and the effect of shear on the viscosity of the sample.

Designed to overcome these challenges, the RVA 4800 heats samples up to 140°C. As such, »

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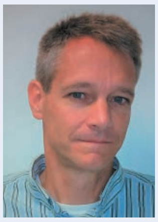

Wes Shadow
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Enhancing functional, compositional, and safety testing in the grain industry

Grain expert, Wes Shadow, outlines PerkinElmer's analytical offering to ensure grain is used to its full potential.

Grains are the foundation of almost all food – from direct consumption and ingredients such as wheat flour, to primary sustenance for livestock. Consequently, grains have strong, highly varied compositional, functional and safety requirements.

Grains vary in their macronutrient and micronutrient composition, which can affect their market and nutritional value. Proximate analysis provides an intuitive solution to assess grain quality and ensure accurate payments. PerkinElmer's family of Near Infrared (NIR) analysers help farmers, traders, and processors accurately analyse the critical components of grains, such as moisture, protein and fat content.

Functionality is an important component of grain quality. A grain ingredient might be acceptable for use in one end-product and not effective in another. Our Rapid Visco Analyser® and doughLAB instruments help ingredient suppliers and processors to match ingredients with required functionality.

Sprout damage of wheat can have a severe impact on grain value and end-product quality. Provided by PerkinElmer, the Perten Falling Number® systems offer unique access to our world-standard method for detecting sprout damaged wheat and flour.

Mycotoxins are toxic metabolites that can contaminate grains causing mould infection of crops. PerkinElmer offers a comprehensive solution for grain mycotoxin testing across environments. At the field, in-take and small-lab scale, the AuroFlow™ lateral flow strip tests enable rapid quantitative detection and screening. For larger processors and contract labs, MaxSignal® ELISA Kits provide high-throughput capacity. For full confirmatory analysis our advanced QSight Triple Quad LC/MS/MS technology monitors multiple mycotoxins simultaneously.

As the global population rises, grain-based foods will continue to play a central role in providing the world's nutrition. PerkinElmer is equipped with analytical technologies that can be leveraged at every step of the food chain to ensure grain is used to its maximum value.

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For further information, visit:
www.perkinelmer.com/category/grain-testing-solutions

Dr Yongfeng Ai

Dr Yongfeng Ai received his PhD in Food Science and Technology from Iowa State University, USA. Currently, in his role as Assistant Professor at the University of Saskatchewan, his research is focused on investigating carbohydrates, dietary fibres, crop quality and processing. Through his leading research, he has authored several articles published in many international journals. Yongfeng is also Research Chair in Carbohydrate Quality & Utilization at University of Saskatchewan, Saskatoon.

Wes Shadow

Wes is the Global Market Manager for Grain as part of the Food segment at PerkinElmer. After graduating from Westminster College in Utah he has forged a 25-year career in the scientific industry serving the global food and grain market. In his current role, he works to showcase PerkinElmer's best-in-class portfolio of grain analysis and testing solutions and services to help assure ingredient-to-product quality and safety for producers and consumers.

we have increasingly noticed that food scientists are leveraging this tool to study the behaviours of starch ingredients at processing temperatures above 95°C. Leveraging such technology allows researchers, formulators and manufacturers to better mimic the high-temperature conditions seen in processing at a small-scale level. This allows food manufacturers to make better decisions with deeper insights when optimising formulations.

However, viscosity analysis alone will fail to capture the full physical experience of a new product.

To gain deeper insights into the functional properties of these ingredients, Dr Yongfeng Ai's team at the University of Saskatchewan combines RVA technologies with Differential Scanning Calorimetry (DSC) tools to monitor starches.[5,6] DSC measures thermal changes during the process rather than viscosity changes. It is particularly suitable for the analysis of food systems because they are often subjected to heating or cooling during processing. The calorimetric information from DSC studies can be directly used to understand the thermal transitions that the food system may undergo during processing or storage.

Utilising specialised tools designed to combat the unique complexities of food testing, such as functional and compositional pulse analysis, producers can greatly accelerate product design and reduce production costs. Additionally, by providing quality control staff with training for pulse product analysis, processors can ensure their innovative products meet consumer demand for appearance, flavour and texture.

Beyond the pea: checking your pulse with RVA

As demonstrated by the rise in meatless burgers, consumers' quest for alternative protein is driving innovation across several ingredient categories, particularly pulses.

Other pulses, such as beans and lentils (as well as peas), are a nutrient-rich, economical source of protein, dietary fibres, vitamins, minerals and antioxidants. These compositional factors make them ideal ingredients for novel products aimed at satisfying consumer demands for 'healthy' foods. However, pulse crops can be unpredictable, and the nutritional components can vary greatly with the growing location, germination season and environment.

For processors to ensure unstandardised harvests can still be utilised in blends to produce a reliable product, powerful monitoring tools must be leveraged to better monitor the compositional quality.

Furthermore, as well as novel products, processors are also investigating how they can enhance the nutritional and functional properties of traditional food items, such as bread and pasta products. In these products, the functional properties of pulses and pulse-based extracts, including being gluten-free, hypoallergenic, and non-GMO, provide food producers with a ready solution in their pursuit of novel ingredients.

Incorporating these ingredients into traditional formulations can present a challenge for food processors. They can greatly impact processability and its resulting performance. Furthermore, developing new formulations can be a lengthy and costly process for new players entering the plant-protein market.

To ensure consistent, high-quality food products, strong quality control procedures can assist processors to understand the many variables that affect new products during development. The RVA provides robust methods to monitor different batches, changes in formulation, and modifications of processing conditions. Additionally, as the RVA records methodology, processors can ensure reliable and repeatable procedures and easy-to-interpret results. Unfortunately, within the industry there are no set standards for producing the 'perfect product'. New product development is often a mixture of innovation, expertise, and an evolving process of trial and error. By recording methodologies, processors can ensure that their product breakthroughs are repeatable and ready for the next stage of development.

Achieving consistent quality

In today's constantly evolving food market, producing consistently high-quality products is the foundational goal for any food processor. Producing food products at a high level of quality requires a commitment to product design, development and manufacturing.

Therefore, the emerging industry must equip itself with the expertise and advanced analytical technologies needed to provide the products of tomorrow. When developing new plant-based products, it is important to realise that the smallest difference in R&D can make a big difference to the final product quality.

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