

Navigating High-protein Flour Challenges **with** Complementary Technologies

Consumer demand for high-protein baked goods is no longer considered a short-term fad. High-protein diets have gained popularity due to their potential benefits for weight management, muscle building, and overall health. Therefore, many of the world's bakery brands are exploring new protein-packed product formulations to meet this need and remain competitive.

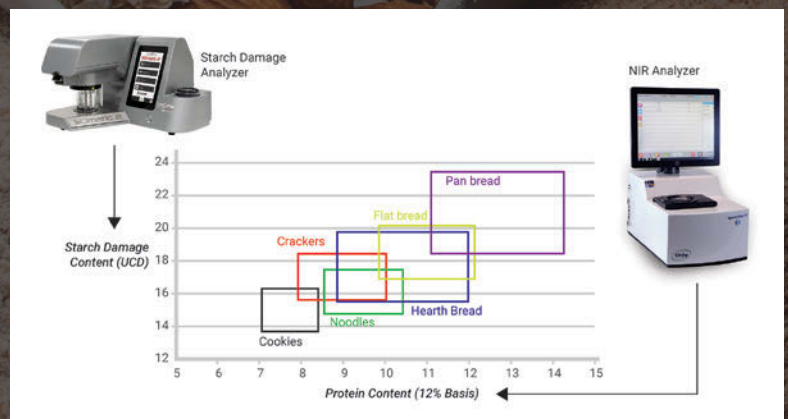
By Arnaud Dubat, Products and Applications Director, KPM Analytics

From whole wheat to plant-based pulses, keto, and other formulations, many alternative flours are finding their way into recipes that were rarely seen in bakeries 10-to-20 years ago. As bakers know, however, these flours can upset the baking chemistry. Even with a perfectly controlled production environment, a baked product typically produced with white wheat flour will yield a much different result if baked with pea, quinoa, cricket, or another flour type. Achieving a high-protein baked product recipe that meets brand standards for volume, texture, color, taste, and other consumer-driven attributes is an iterative process. And, even if that recipe meets standards on a pilot scale, there are challenges bakeries must manage with high-protein flour, such as dough stickiness, production variations due to ingredient quality, and final product appearance. The good news is that many tools used to analyze and control the quality of baked goods created with white wheat flour have advanced to accommodate high-protein alternatives.

BEGIN BY ESTABLISHING A BALANCE OF PROTEIN WITH OTHER ESSENTIAL FLOUR ATTRIBUTES

One trait common with whole wheat and high-protein flours is that many have a high water absorption capacity, which affects the bakery's bottom line. Most baking brands strive to sell their products at the price of water. However, along with these flour types' high water absorption capacity, dough stickiness remains a common issue, leading to machinability challenges and a disappointing final product.

The dough becomes sticky because too much water is added during mixing and is, therefore, leaking out of the dough. Adjusting hydration or adding improvers to improve dough consistency is much easier on an individual scale than on a high-volume production line. However, while protein is a vital component in any flour type, one parameter in all flour directly impacts dough stickiness: damaged starch. Damaged starch is very hygroscopic and absorbs water quickly. However, during the mixing phase, the starch granules release water. Protein then sucks up this excess moisture. If flour has too much or too little damaged starch content and a weak balance with protein, the baker will end up with a sticky dough.



Finding a balance between starch damage (UCD) and protein of a flour is important for bakeries to control dough stickiness and maintain product consistency – a common issue with high-protein baked products. This is achieved by combining data from an automated starch damage analyzer (SDmatic 2 shown) with NIR technology (SpectraStar™ XT Series NIR Analyzer shown).

Here is where technology can help: There are tried and tested tools to help bakers determine this balance of damaged starch and protein. First, for protein analysis, near-infrared analyzers (NIR) have long existed as a fast and straightforward method to analyze flour protein content with high accuracy. Additionally, many calibrations exist today for different high-protein flour varieties.

Then, an automated tool like the SDmatic 2 analyzer quickly determines damaged starch content using only a small flour sample.

With a better understanding of the relationship between protein and starch, bakeries can fine-tune their recipes to achieve a product that meets expectations.

TESTING PRODUCT FORMULATIONS TO MANAGE VARIABILITY IN INGREDIENT QUALITY BEFORE PRODUCTION

Since many high-protein flour varieties are still relatively new to the baking industry, quality control from suppliers is not as strong as it is for white wheat flour. Very little reference data exists for many high-protein flour alternatives.

Baking tests are the gold standard to understand how flour will adapt to produce a specific product. While necessary for quality control, baking trials take time and use purchased ingredients. This fact means bakeries immediately take a percentage loss on their investment regardless of whether it meets the specifications for their process. These losses are compounded when working with high-protein flour varieties, which are often more expensive than white wheat flour and other more common ingredients.

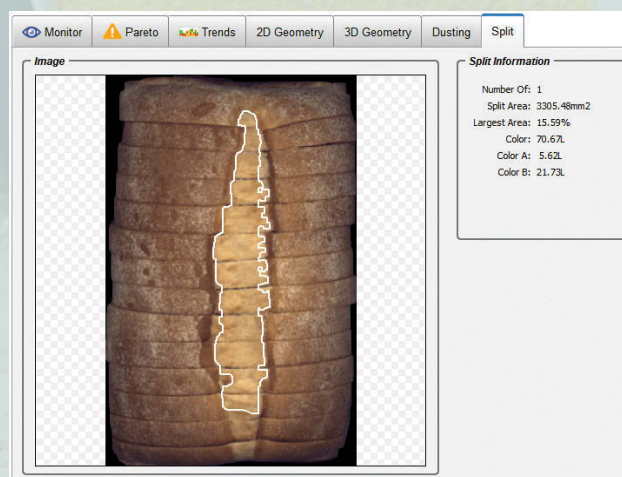
However, a universal dough characterization tool like Mixolab 2 can help bakers streamline baking trials by simulating the baking process with a small flour sample – including high-protein flour alternatives like pea, lentil, keto mixes, and others. Dough characterizers analyze samples for vital quality criteria such as water absorption, dough stability during mixing, gluten resistance to heat, viscosity, and starch retrogradation, which relates to the final product shelf life. Bakers incorporating dough characterizers into their process can create efficient and modern specifications for working with high-protein flour and alternatives based on their ideal final products. After analysis, which typically lasts between 30-to-40 minutes, bakers can use their benchmark quality data from the dough characterizer to immediately accept or reject the flour from their supplier or adjust their flour formulations (change hydration, add improvers/enzymes, etc.). This application allows bakers to move on to their baking trials more confidently, thereby reducing wasted ingredients and holding their suppliers accountable.

OBJECTIVE ANALYSIS OF PRODUCTS IN THE R&D PHASE

Baked products produced with a blend of whole wheat or high-protein flour inherently look different compared to those produced solely with white wheat flour. However, it is up to the baker to make the necessary adjustments to their recipes or the production process to mediate

variations that can be turn-offs to consumers.

Vision inspection technologies offer many benefits to a bakery's product development process today. For instance, in developing a recipe for a high-protein product variety, the R&D bakers can objectively compare the final product results against different formulations (or against the flagship white-wheat flour product) to find a recipe that meets standards for final product size, shape, color, volume, texture, and other attributes.



Vision inspection technologies help bakers fine tune their production process to consistently achieve visual traits of their high-protein products, such as split uniformity and depth of a loaf of bread.

Benchtop vision inspection technologies are great tools to help baking operations better understand the tolerances of their production process, helping them achieve consistent baked goods across their complete product line. They combine the data of typical analog measurement tools like calipers, colorimeters, comparison charts, and others, into a single, fast, easy-to-use instrument.

BAKERS: TAKE A MORE DECISIVE ROLE IN QUALITY CONTROL

Developing a Certificate of Acceptance (COA) for high-protein flour alternatives is not the same process as a COA for gluten-rich white wheat flour. Because most high-protein flour varieties are new to the industry, they lack the decades of research and production know-how that experienced bakers can rely on to achieve a consistent product.

This presents a significant opportunity for bakers to take a stronger role in the quality control process as they forge a path that few others have chartered. Rather than relying solely on the miller's specifications or quality "curves," it is up to the baker to conduct experiments and become more familiar with how an alternative flour will adapt to create a recipe that meets their product standards.

For bakers to define what is suitable for their products, it is essential to view the process from the finished product to the flour. The baker knows better than anyone else the characteristics that make their products unique and appealing to consumers. As demand for high-protein baked product alternatives continues to grow, bakeries are in a great position to command quality thanks to these technologies. •