Strategies for Good Quality Gluten-free Products

The gluten-free market holds a substantial share in the bakery market, with an expected cumulative growth of about 10% until 2025.[1] From bread to cake and everything in between, there is room for innovation in the market. Producing a quality and consistent gluten-free product hinges on the ingredients used. The replacement solutions available today are vast and varied. However, they all need to fill in for key gluten functionality, as well as be held to a standard of quality and reliability.

Gluten is a cluster of proteins found in the endosperm of cereals like wheat. Currently seven of every 1,000 people in the US (over 2 million people in total) suffer from an immune (celiac) disease. The other significant disorders include gluten sensitivity and wheat allergy, leading to respiratory distress and digestive disorders. Furthermore, health conscious consumers also avoid gluten consumption as a part of a healthy lifestyle which boosts the high-value market.

Gluten's Role in Baking

In water, gliadin and glutenin proteins interact to establish bonds and form small protein strands. This is the basis for how a cohesive viscoelastic gluten matrix is developed. It's essential for retaining gases during fermentation. In dough, gluten provides three key functions in baking formulas:

- Network: the gluten protein cluster forms an elastic network that provides stretching and extensibility to the baked goods.

- Functionality: gluten aids in dough formation by reacting with water to form gas pockets during the mixing process. The elasticity of the network aids in raising the dough during proofing and baking by entrapping the air. The network elasticity aids to avoid dough collapse in these processing steps.

- Texture: the gluten network provides a unique texture to the baked products due to the earlier discussed properties.

While developing gluten-free products, finding a single ingredient replacement is extremely difficult to provide the same functionality. Furthermore, gluten-free products are also vulnerable to quality variability and limitations in quality control tools.

Ingredients to Replace Gluten

Gluten properties are replicated using a combination of different ingredients. The following list contains primary alternates and their functional purposes.

1. **Gluten-free flours and starches:** Formulation base for replacing wheat flour. Examples: rice, corn, buckwheat, quinoa.

2. **Gums and hydrocolloids:** Increase water absorption and further aid in increasing product volumes. Examples: CMC, carrageenan, proteins, soybean, egg.

3. **Tubers and legumes:** Nutritional and functional properties. Examples: lentils, peas, tapioca.

4. **Enzymes:** Optimize dough behavior and final dough modification. Examples: alpha-amylase, sugar oxidases, transglutaminase.

TOP TIP:

Here are some necessary steps to consider for developing successful gluten-free products:

- Functional alternative raw material
- Consistent quality of raw material
- Formulation adaptation for variation in raw material
- Achieving optimum water level depending on mixing and baking properties
- Improving product quality using dough strengthening enzymes
- Analyzing rheological properties of doughs and mixes

Quality Control for Gluten-free Products

The gluten-free product market aims to achieve the same standards of gluten-containing products. The flavor profile, texture, and shelf life of these products use gluten-containing products as benchmarks. Like conventional products, gluten-free ingredients contain inevitable quality variability depending on the agricultural, climate, or processing differences. Hence, it is crucial to analyze the quality of these raw materials for a consistent processing line and product quality.

Furthermore, the quality equipment and tests focus on conventional products, and gluten receives crucial attention. In the case of gluten-free products, the focus needs to recalibrate on starch and alternative raw materials. Still, not enough analysis instruments are available for gluten-free systems unfortunately.

The rheological properties of dough can predict properties such as water absorption, stability, and air incorporation in the early stage of product development. The rheological behavior of different raw materials is significantly different. The base material in gluten-free products often contains rice, corn, sorghum, soy, potato, quinoa, or other flours. These flours have significantly different rheological behavior. It is important to note that the variety of ingredients used to mimic the properties of gluten requires for protocol to be redesigned in every operation.

Fortunately, the Mixolab 2, a quality analysis instrument from CHOPIN Technologies, contains a built-in solution for different raw materials. This equipment recalibrates the properties according to the ingredient used and hence, reduces the manual effort required to do the same.[2]

The Mixolab 2 allows bakers and food professionals to do multiple tests using a single device. It analyzes gluten-free mixes,raw materials formulations, and final products. These multiple analysis methods combined with in-built rheological measurement make it less time-consuming and cost-effective. In a single test, the Mixolab 2 analyzes:

- Water Absorption
- Effect of mixing
- Development time
- Protein denaturation
- Starch gelatinization
- Amylase activity
- Stability
- Starch retrogradation

Quality Control (cont.)

The Mixolab 2 also incorporates protocols for different raw materials following different rheological behaviors. It does not require any additional accessories or protocol modification. For developing a gluten free product, the first step involves determining the end product and its properties that one would like to mimic. These properties should be objective and hence, measurable and comparable. Such properties can include starch gelatinization, water absorption and retention and more. Defining an excellent final product in early steps helps in formulating strategies. The next step is to characterize all the processing steps and distinguish each step's good product.

The next step involves trying alternative ingredients formulation and comparing it with the outcomes of the benchmarked product. Finally, altering the ingredient, combining different ingredients and the modification of the processing step aids in developing a better final product.

GLUTEN FREE CERTIFICATION

Products manufactured by successfully meeting and implementing specific criteria are eligible for gluten-free certification after completing a series of plant audits and laboratory data analysis. Third-party certification agencies set these criteria for manufacturing "free-from-gluten products."

GFCO (Gluten-free Certification Organization) started gluten-free certification in 2005 (Canada) and is currently a rapidly growing gluten-free certification organization in North America. The FDA requirement for gluten-free products is 20 ppm (Codex Alimentarius, CODEX STAN 118), which is also the international standard. The GFCO maximum is ten ppm gluten in a food product. The Celiac Sprue Association Seal of recognition requires less than five ppm gluten.[3] According to Codex Alimentarius and European regulations, products containing less than 100 ppm gluten can claim "very low gluten products."

When analyzing gluten-free flours, can high particle size (e.g from corn flour) be an issue?

In an investigation, flour with compact microstructure and large particle sizes resulted in a higher specific bread volume. The particle size of maize starch affects the product's final volume and texture.

The larger size of maize granules provides more volume and less firmness to bread. The bread made using finer flour has less dough available to retain the gas produced during fermentation and increase bread volume. Furthermore, other factors need to be accounted for such as the variety of ingredients, and milling process.[4] High particle-sized flours react differently in mixing, but is not an issue with analysis equipment like the Mixolab.

What kinds of gums are recommended to use with quinoa or gluten-free cereals in general?

The type of gum to be used in a product depends heavily on the required functionality in the product. Xanthan is the most commonly used bakery gum as a humectant, texture enhancer, and viscosity builder. Gums such as hydroxypropyl methylcellulose (HPMC), locust bean gum, guar gum, carrageenan, xanthan gum, and agar give the successful formation of bread from pseudo-cereal such as rice and quinoa. HPMC gives optimum volume expansion and mimics better bread characteristics.[5]

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